

ESSAYS ON THE CHINESE LABOR MARKET

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ESSAYS ON THE CHINESE LABOR MARKET

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This dissertation examines the central features of the current Chinese labor market, investigates the functioning of China's labor market by constructing a theoretical model, and conducts a comprehensive welfare economic analysis using the model to study welfare consequences of various labor market policies.

The dissertation consists of six chapters. Following the introduction of Chapter 1, Chapter 2 reviews key features of the current Chinese labor market based on previous literature, including labor market segmentation, household registration system, wage evolution, employment structure, etc. However, previous studies have not provided a satisfactory answer about the extent of hukou-based labor market discrimination in firms with different ownerships. Chapter 3 fills in this gap by providing more convincing empirical evidence on this particular feature using a double-selectivity approach. The results show that state-owned enterprises (SOE) are much more discriminatory than private firms against rural-to-urban migrants who carry their rural hukou to cities. The SOE sector practices both wage and hiring discrimination against rural hukou holders.

Based on these empirical results, Chapter 4 constructs a theoretical model for the current Chinese labor market. The model has two geographically distinct areas (urban and rural), three

segmented economic sectors (SOE, private, and agriculture), and two types of workers distinguished by the hukou status (urban and rural hukou). The paper first formulates the model and obtains a closed form solution before modeling any policy interventions. Chapter 5 then works out the labor market and welfare consequences of three policy interventions which include promoting rural development, reducing the cost-of-living in urban areas for rural hukou holders, and offering some rural workers the chance to convert from rural to urban hukou status. The policy analysis includes small increases in each of these three areas, followed by the allocation of a specified development budget among these three alternative uses. It is shown that the rural development policy is unambiguously welfare-improving, while the other two policies have ambiguous effects on social welfare. Chapter 6 concludes.

BIOGRAPHICAL SKETCH

Yang Song was born in China on February 2, 1985. He received the Bachelor degree from Renmin University of China in 2007, majoring in Labor and Social Security. He then came to Cornell University in 2007 for a Master degree at Cornell Institute for Public Affairs (CIPA). After obtaining the Master of Public Administration in 2009, He entered the Ph. D program in Economics at Cornell University. His main research interests lie in labor and development economics, with a particular focus on the labor market in China. He expects to receive the Ph. D degree in Economics in the January of 2013.

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Chapter 1 Introduction

This dissertation reviews the literature on the central features of the current Chinese labor market, incorporates these features to construct a theoretical labor market model for China, and then conducts a comprehensive welfare economic analysis using the model to study welfare consequences of various labor market policies.

China's labor market was freed up greatly beginning in 1978 as part of the larger economic reforms introduced at that time. Previously, there had been no labor market; all workers had been assigned to jobs. Since the 1990s, workers have been largely free to search for better jobs, and employers have been largely free to hire and fire workers as desired. Moreover, the past twenty years witnessed also a steady urbanization process in China featuring an increasing flow of labor from rural areas to cities as regulations on rural-urban migration have been slowly relaxed.

However, the current Chinese labor market has some unique features that are not only different from other countries' labor market, but also different from what it used to be two decades ago. The main features include labor market segmentation and household registration system (hukou). First, the current Chinese labor market is segmented involving state-owned enterprises (SOE), private enterprises, and agriculture sector. The

three employment sectors pay different wages to comparable workers, with the SOE sector on top, private sector in middle, and agriculture sector at bottom. Furthermore, high-wage jobs are rationed meaning that there are qualified individuals who would like to find a high-wage job but cannot find a job there due to the lack of good jobs in this sector. Second, the household registration system requires that each person born in China should be classified either rural *hukou* or urban *hukou* in a given location. Workers with different hukou are treated differently in the urban labor market, face different costs of living in cities, and have different access to government-provided public service and welfare programs in the urban area.

Based on these unique features, this dissertation constructs a theoretical labor market model for China, and utilizes the model to examine the welfare consequences of various labor market policies.

The dissertation consists of six chapters. Following the introduction of chapter 1, Chapter 2 reviews key features of the current Chinese labor market based on previous literature. Chapter 3 provides new empirical evidence on the degree of hukou-based labor market discrimination in different segmented ownership sectors in urban China including state-owned enterprises (SOE) and private firms. Based on these empirical results, Chapter 4 constructs a theoretical model for the current Chinese labor market, and Chapter 5 studies the effects of various labor market policies on social welfare using the

model by various policy evaluation criteria. Chapter 6 concludes and provides directions for future research.

Both empirical and theoretical analysis is carried out on the Chinese labor market throughout the dissertation. Chapter 2 and 3 are mainly empirical chapters and are written by myself. Chapter 4 and 5 are two theoretical papers, which are the joint work with Professor Gary Fields.

Chapter 2 attempts to be hitherto the most comprehensive and detailed analysis of the central features of the current Chinese labor market from labor economists' point of view. A considerable number of previous studies have only touched on several pieces of China's labor market, but none of them have given us a clear and complete picture. Moreover, many previous studies on this topic lacked economics foundation and failed to utilize the framework of economics to describe and explain the Chinese labor market, such as demand and supply, wages, and so on. This paper intends to fill in this gap and tries to analyze the main features of the current Chinese labor market from the perspective of labor economics. The paper summarizes 10 central features of China's labor market as follows.

1. Nearly half of total labor force in China is working in rural areas and the other half

is working in urban China; Within rural areas, more than one half of the rural labor force is still working in agriculture sector, and the rest is working in rural non-agriculture sector concentrated in eastern China; Within urban labor force, more than three quarters are working in private sector.

2. Urban and rural wages have both been increasing, but urban wages have grown much faster than rural wages, and now the average urban wage is approximately four times as high as the average rural wage.

3. Urban and rural hukou holders face different costs of living in cities and have different access to government-provided public service and welfare programs in the urban area.

4. Workers with rural hukou earn lower wages and are less likely to be hired in the high-wage sector in urban areas compared to workers with local urban hukou due to both differences in human capital and labor market discrimination.

5. The phenomena of urban labor shortage and rural labor surplus are co-existent in the current Chinese labor market.

6. Open unemployment is low in China and is mainly concentrated in cities of central and western China.

7. There exists labor market segmentation between rural and urban labor market as well as within urban labor market between different ownerships

8. Wages in urban private sector are largely market-determined, and institutional interventions play a small role in wage-setting mechanism in urban private sector.

9. Skilled workers have experienced a much larger wage increase than unskilled workers.

10. About 10 percent of urban labor force in China is self-employed, and a substantial share of wage and salary employees in urban areas is not covered by social insurance programs.

Chapter 3 is the first empirical study in China comparing the extent of labor market discrimination against rural hukou in two segmented ownership sectors in urban China, including state-owned enterprises and private firms. This paper also makes a methodological contribution to the empirical literature on labor market discrimination in

China by adopting a double-selectivity approach to account for selectivity both in sector determination and in hukou status. The first selectivity comes from the possibility that people working in the SOE sector are not a random sample of the underlying population. For example, people with certain characteristics such as more government networking may be favored by stated-owned enterprises (SOE) and thus more likely to work there. Another selection problem arises because the hukou status can be endogenous in that some Chinese people are now allowed to convert their hukou from rural to urban upon meeting some criteria specified by each local government.

By utilizing the 2008 wave of the Rural-Urban Migration in China (RUMiC) survey, I find that rural migrants who carry their rural hukou to cities face both wage discrimination and hiring discrimination in urban China, especially in the high-wage SOE sector. Specifically, the selectivity-corrected results show that for observationally-equivalent workers, urban hukou holders earn about 50% more than rural hukou holders do in the SOE sector, but only 5% more in the private sector. In addition, there exists obvious hiring discrimination against rural hukou holders in the SOE sector. Comparable workers with rural hukou are 35 percentage points less likely to be hired in the high-wage SOE sector than urban hukou holders.

Chapter 4 formulates a theoretical model to incorporate the most important features of the current Chinese labor market and to demonstrate how this model might be utilized

to analyze the labor allocation as well as the wages in different economic sectors. As Fields (2007) pointed out, good policy work requires sound theoretical foundations. The major existing theoretical models of employment and development-the Lewis-Fei-Ranis model, the integrated labor market model, the Harris-Todaro model, and various segmented labor market models – stylize different developing countries’ labor markets in different ways. None, however, stylizes conditions in any of the major developing countries. This paper is the first one aimed at remedying this gap in the literature.

The model developed in Chapter 4 has two geographically distinct areas (urban and rural), three segmented economic sectors (SOE, private, and agriculture), and two types of workers distinguished by the hukou status (urban and rural hukou). The paper formulates the model and obtains a closed form solution, and then models a number of policy interventions. It shows that the hukou system affects the current Chinese labor market through two major channels. One is that there are both hiring discrimination and wage discrimination in the urban state-owned enterprises (SOE) against rural hukou holders which reduce their expected payoffs associated with migrating to the city. Another is that rural hukou holders have to bear a large amount of cost of living in the city, but cannot have enough access to various welfare programs and public services provided by city governments as urban hukou holders do. These two mechanisms together in fact explain the puzzle observed in current China that a considerable number

of rural hukou holders still choose to stay in the poor rural area and earn very little, instead of migrating to the coastal city where labor shortages are endemic and wages are higher.

Based on the newly-developed theoretical model, Chapter 5 then conducts a careful and comprehensive welfare economic analysis of three labor market policies, including rural development (RD), reducing the cost of living for rural hukou holders in the city (RC), and converting some rural migrants' hukou status from rural to urban (HC), which are the most discussed and relevant policies in the current Chinese labor market policy agenda (Hertal and Zhai, 2006; Whalley and Zhang, 2007; Ito, 2008). There is no consensus among policy analysts and decision makers about whether each of the three policies above is desirable for the society or not, and also about which policy among the three alternatives should deserve priority.

Firstly, by ignoring the costs associated with implementing each policy, I adopt two alternative policy evaluation criteria including first-order welfare dominance approach and abbreviated social welfare function to compare the income distributions generated by each of the three policies with the original distribution, respectively, answering the question that which policy would increase social welfare and which would not. Secondly, I conduct a social cost-benefit analysis by taking into account of the costs of each policy

and using a public finance framework, examining which policy the central government should choose given a fixed budget to increase social welfare the most measured by first-order-welfare-dominance and first-order-poverty-dominance criteria, respectively. The following conclusions are drawn from these analyses.

First, according to the first-order-welfare-dominance criterion, only the rural development policy yields an unambiguously welfare-improving income distribution. The reduced cost policy and hukou conversion policy have ambiguous effects on social welfare using the first-order-welfare-dominance approach in that neither the distribution generated by each policy first-order-welfare-dominates the original distribution nor dominated by it. None of the three policies is welfare-decreasing using the first-order welfare dominance criterion.

Second, according to the abbreviated social welfare function in which social welfare depends positively on total income, and negatively on income inequality and poverty, we obtain similar results as above that only the rural development policy unambiguously increases social welfare, while the other two policies have ambiguous effects on social welfare.

Third, we take into account the cost of each policy and examine which policy the

central government should choose with a fixed budget to increase social welfare the most measured by first-order-welfare-dominance and first-order-poverty-dominance criteria, respectively. We compare the three hypothetical income distributions resulting from the three respective policies using the fixed amount of budget. The budget is assumed to be not large enough to change the ordering of discretionary income among groups in the original equilibrium before any policy interventions.

According to the first-order-welfare-dominance criterion, none of the three policies with the same fixed budget would generate an income distribution that first-order-welfare-dominates the income distributions resulting from either of the other two policies. That is, no single policy among the three alternatives is unambiguously better than another one by first-order welfare dominance approach.

Fourth, by assuming that one dollar budget allocated to an agriculture worker for the rural development policy could generate M dollar income increase for each agriculture worker, we find that the results using the first-order-poverty-dominance approach depend on how large the multiplier effect (measured by the value of M) is. If the multiplier is sufficiently small, no policy would generate an income distribution that first-order-poverty-dominates the distributions resulting from either of the other two policies. If the multiplier is sufficiently large, then the rural development policy has a

larger effect on poverty reduction than the reduced cost policy. However, neither the rural development policy first-order-poverty-dominates the *hukou* conversion policy nor dominated by it, in that the very poor people have higher income under the rural development policy than the *hukou* conversion policy, whereas the richer of the poor people have lower income under the rural development policy than the *hukou* conversion policy.

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Chapter 2 Central Features of the Current Chinese Labor Market

2.1 Introduction

Since the market-oriented economic reform began in 1978, China has undergone a fundamental transformation in the labor market. In the planned economy before 1978, the Chinese government had control over nearly every aspect of the labor market, including employment and wages. Job-seekers were assigned employment, through universities or local governments. Most people worked in state-owned enterprises and enjoyed lifetime employment with no risk of being fired. Labor mobility was almost non-existent. It was the government, rather than the market, that arranged the allocation of labor. The Chinese labor system was characterized by immobility, lack of incentives, overstaffing, and underemployment (Knight and Song, 1995).

From 1978, China has shifted gradually from planned allocation of labor in state-sector jobs to a more open labor market with increasing numbers of workers employed in the private sector. In particular, from the mid-1990s, job-seekers have become free to choose jobs, and employers have more flexibility to make decisions on hiring and firing. Since then, Chinese labor market started to burgeon, in which

employers make hiring decisions to maximize profit while workers make labor supply decisions to maximize utility. Thus, we could conclude that Chinese labor market in pure economics sense has only lasted for about fifteen years.

The past thirty years witnessed also a steady urbanization process in China featuring an increasing flow of labor from rural areas to cities as regulations on rural-urban migration have been slowly relaxed. Based on official data, Cai, Park, and Zhao (2009) reported that from 1978 to 2005, the share of labor employed primarily in agriculture fell from 71 percent to 45 percent.

Although the large structural changes in Chinese labor market are impressive, labor market reform is still limited in comparison with other market reforms in China. The main challenge lies in the political difficulty of eliminating a set of institutions and policies that privileged the welfare of some urban workers by paying high wages in state-owned enterprises. Due to these limitations, Chinese labor market is currently highly segmented. According to Fields (2007), labor market segmentation is defined as follows: different wages are paid in different sectors to comparable workers. Specifically, there are two critical elements within segmented labor market (Dickens and Lang, 1985). First, workers with the same level of human capital earn different wages in different sectors. Second, more importantly, better jobs are rationed. That is, there are qualified

individuals who would like to find a higher-pay job but cannot find a job there due to the lack of good jobs in this sector. That the current Chinese labor market in China is segmented is a main consensus among economists on the Chinese labor market (Song and Li, 2010; Chen and Huang, 2010; Chen and Huang, 2009; Zhao, 2005).

The recent economic recession had a big negative effect on the Chinese labor market. The abruptness of the economic downturn caused nearly 70 million of rural migrant working in cities to return home in 2008. The fall was short-lived, however, and employment has been rising since the beginning of 2009. To date, the Chinese labor market has proved exceptionally resilient in the face of the financial crisis and economic recession. As far as migrant workers were concerned, government reports suggest that by August 2009, 67 million of those who returned home in late 2008 had gone back to cities, and an extra 7 million new migrants moved to cities in the first half of 2009. The unemployment rate amongst migrants was only 3% by June 2009 (Wang, 2009). The Chinese government's macroeconomic policy in response to the financial crisis led the number of rural migrant workers to rebound to pre-crisis levels by the end of 2009 (Li, 2010a).

Due to the institutional changes and reforms, the current Chinese labor market has some special features. It is different from the classical textbook labor market in which

different firms pay the same wage to comparable workers, the wage being set by supply and demand to clear the market. The current Chinese labor market is way more complicated than the classical model. For instance, we observe the fact that different wages are paid for observationally-equivalent workers in different sectors.

The biggest contribution of this chapter is that it attempts to be hitherto the most comprehensive and detailed analysis of the central features of the current Chinese labor market from labor economists' point of view. A considerable number of previous studies have only touched on several pieces of China's labor market, but none of them have given us a clear and complete picture. Moreover, many previous studies on this topic lacked economics foundation and failed to utilize the framework of economics to describe and explain the Chinese labor market, such as demand and supply, wages, and so on. This paper intends to fill in this gap and tries to analyze the main features of the current Chinese labor market from the perspective of labor economics. Based on a comprehensive literature research, I summarize 10 central features as follows.

2.2 Ten central features of the current Chinese labor market

2.2.1 Employment structure

Nearly half of total labor force in China is working in rural areas and the other half is

working in urban China; Within rural areas, more than one half of the rural labor force is still working in agriculture sector, and the rest is working in rural non-agriculture sector concentrated in eastern China; Within urban labor force, more than three quarters are working in private sector.

2.2.1.1 Division of rural and urban labor force

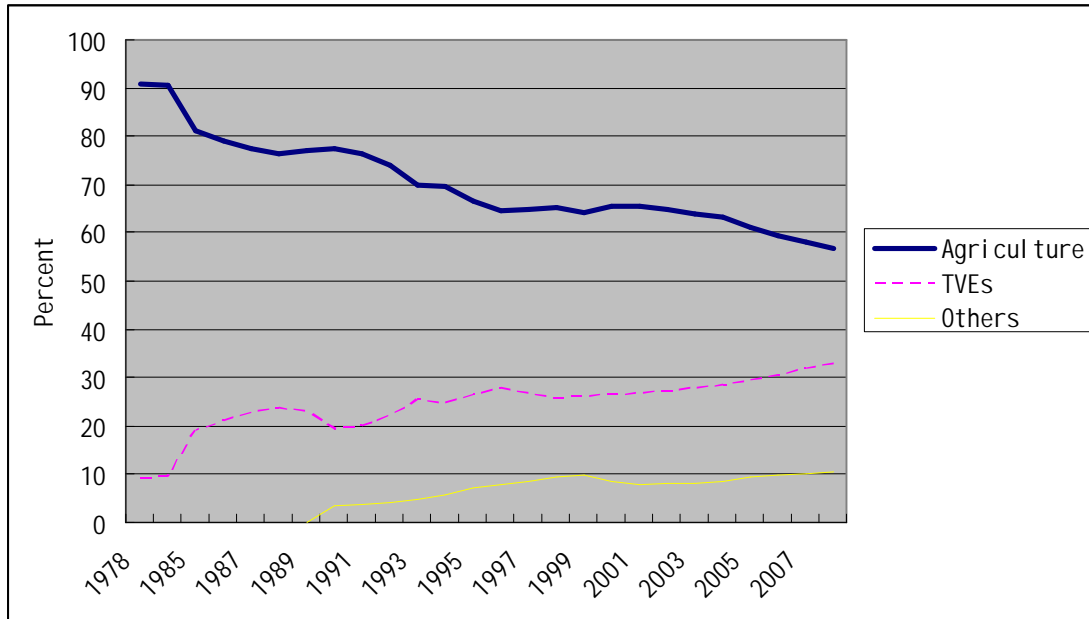
By the end of 2010, the total labor force in China was about 760 million, of which 350 million worked in urban areas (*National bureau of Statistics*, 2011). The share of urban and rural labor force was 46% and 54%, respectively.

Over the last decade, the share of urban labor force has been increasing dramatically. An evident change in the structure of urban labor force in the past ten years is the influx of rural migrants. The most recent data shows that the total number of rural migrants in cities is approximate to 220 million (*National bureau of Statistics*, 2011). Rural-to-urban migration has been a particularly important social phenomenon and has attracted much attention from both policy makers and academic scholars. Hundreds of millions of rural workers migrated to cities to pursue higher income. Due to this huge migration, the share of rural labor force becomes close to the share of urban labor.

2.2.1.2 Rural employment structure

The rural labor force can be divided into agricultural and non-agricultural workers. As noted in the introduction, the percentage of total labor in China working in agriculture fell rapidly by an average of 0.8 percent per year over the last three decades. Currently, nearly 55 percent of the rural people are working in agriculture, and the rest of rural workers are employed in non-agriculture enterprises (National bureau of Statistics, 2011).

The share of agriculture workers in total rural labor has declined substantially over the past three decades, partly owing to the introduction of household responsibility system. In 1978, the Chinese government introduced the household responsibility system (HRS). Under this new system, land is owned by the collectives and contracted out to households. The introduction of HRS meant that labor allocation among family members became household decisions. Families decided who worked on which plot of land or which off-farm activity according to individual members' abilities. Since rural families have more options and flexibility to arrange their labor allocation after the introduction of HRS, as a share of rural labor, the agricultural labor share declined from 91 percent in 1979 to 61 percent in 2003, and to 56 percent in 2008. Figure 2.1 plots this changing trend in the structure of rural employment.



Data source: Chinese Statistical Yearbook (2009)

Note: “Others” in the above figure includes private enterprises and self-employed workers. TVE denotes township and village enterprises in rural areas.

Figure 2.1 Structure of Rural Employment (percent)

As is shown in the figure above, most of non-agriculture rural people are employed in rural enterprises, especially township and village enterprises (TVEs), which are concentrated in coastal provinces. TVEs played a dominant role in creating employment for rural workers. According to the official statistics from the Statistical Bureau of China in 1995, in the 15 years from 1980 and 1994, the number of TVEs had grown 16.5 times and reached 8.75 millions by the end of 1994. In 1994, TVEs employed 120 million workers and contributed to 55.4% of the national industrial output. Currently, nearly 150 million Chinese workers are employed in TVEs (Sun, 2008).

However, the growth of rural non-agricultural activities has been faster along the

coast than in the interior. In 2007, for example, eastern provinces contributed two-thirds of TVEs' GDP, compared with less than one-quarter from central China, 6 percent from the northeast and a mere 5 percent from western regions (Ash, 2010). Most of rural non-agricultural employment is concentrated in rich regions such as eastern coast of China.

In addition, the majority of employers in rural enterprises prefer local residents, and thus most of migrants from poor areas do not have any opportunity to obtain a job in rural non-agricultural firms in rich areas (Shi, 2007). For example, it is almost impossible for a migrant from Inner Mongolia to obtain a job in rural enterprises in Beijing. Yao (1999) argued that when TVEs started to burgeon in 1990s, the local government had much control in the decision-making of town and village enterprises. However, two recent papers show that most of TVEs have made market-oriented reforms and aim to maximize profits, and the intervention from local governments has been largely reduced (Sun, 2008; Shi, 2007).

In terms of rural agricultural employment, self-employment is still dominant. In most places, a person born in the rural area will be automatically allocated a piece of land. Farmers cultivate crops on their own land and sell the products. Due to the "One Child" policy initiated in 1978, the family size has become smaller and similar across rural

families. Accordingly, each family has similar land area. Sun (2008) claimed that agricultural wage is similar across families owing to land allocation policy and similar family size. Feng (2008) said that the land rental market is still in its infancy. Chen et al (2010) provided a specific example of small scale agriculture production in rural China. They investigated agricultural production in Yucheng City, located in the northwest of Shandong Province. Figure 2.2 shows the frequency distribution of per capita arable land in Yucheng city. As is seen, 83.8% of households operated less than 0.2 ha, and just 3.9% did more than 0.3 ha. It indicates that agricultural production in Yucheng is still at the stage of traditional small-business farming.

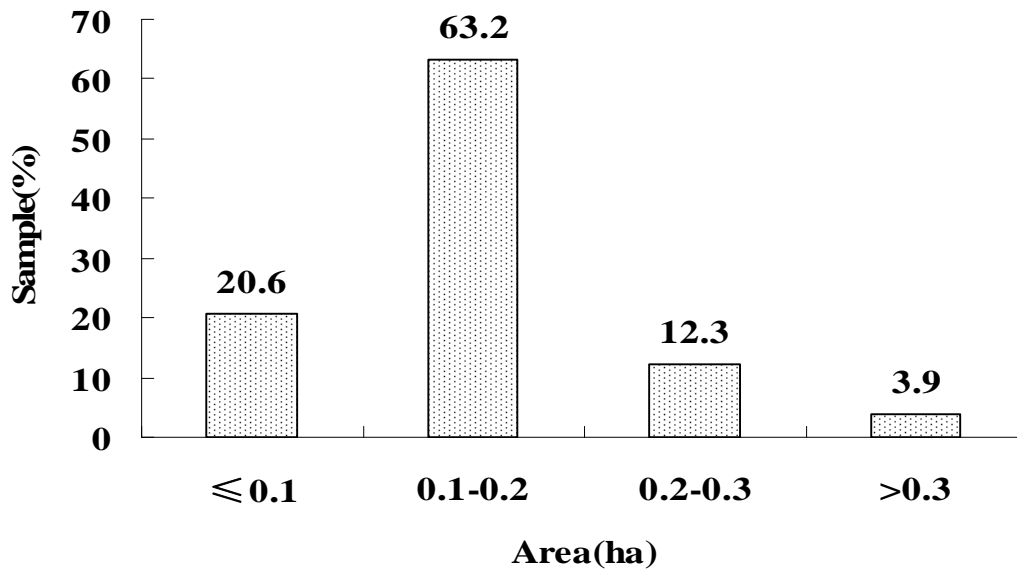


Figure 2.2 Frequency Distribution of Per-capita Arable Land

2.2.1.3 Urban employment structure

In the past twenty years, the share of urban employment in private sector has increased from 24% in 1995 to 76% in 2008. In contrast, the public sector has experienced huge downsizing.

One of the most notable features of Chinese urban labor market is the categorization of employment by ownership. There were two main types of ownerships up to the early phase of the economic reforms: state-owned enterprises (SOEs), urban collective enterprises (UCEs). Things changed quite dramatically starting in 1997, when the Chinese government moved forward with long-delayed plans to diversify ownership of enterprises, and private firms were encouraged. The Chinese Communist Party's 15th Congress held in September 1997 recognized private enterprises as an important component of the economy.

On the other hand, the state sector reform was speeded up after the same Congress held in September 1997, which encouraged both the corporatization of large state-owned enterprises (SOEs) and the restructuring of small SOEs, and allowed inefficient firms to reduce employment or go bankrupt (Lu and Jiang, 2008). The objective of this reform was to shut down loss-making SOEs, to establish modern forms of corporate governance, and to de-link the provision of social services from individual employers.

Since the watershed of 1997, the urban labor market has been reshaped with massive

layoffs by state-owned companies. Due to the previous lifetime employment system in the public sector, until the mid-1990s, SOEs and UCEs still had a huge pool of hidden unemployment featuring overstaffing, shirking, and low productivity. The aggressive economic restructuring led to the layoffs of at least 30 million workers by 2004, mostly from the public sector (Cai, Park, and Zhao, 2009). The huge-scale massive layoffs caused a sharp decrease in the share of urban employment in state sector. Zhang (2010) estimated that from 1998 to 2002, the net employment in SOEs and UCEs experienced a reduction of about 40 million and 20 million, respectively. During the five-year period, nearly 60 million workers lost their jobs in the public sector where they used to enjoy secure employment. Since then, the number of workers in both SOEs and urban collective enterprises (UCEs) kept decreasing, from 144.6 million in 1995 to 71.1 million in 2008 (National Bureau of Statistics, 2011), a total decrease of fifty percent.

2.2.2 Rising wages and rising rural-urban wage inequality

Urban and rural wages have been both increasing, but urban wages have grown much faster than rural wages, and now the average urban wage is approximately four times as high as the average rural wage.

Over the last decade, the wages in both urban and rural areas have been increasing. Cai and Wang (2010) selected 16 sectors where data on average wages were available and

showed that nearly the real average wages in all of those sectors have increased since the mid of 1990s. Figure 2.3 illustrates the increase in the real earnings in urban sector using official data from *National bureau of Statistics*. The data on labor income below is based on surveys for registered agencies and enterprises in urban sector, including state-owned enterprises, private firms, government agencies, and foreign-owned enterprises. That is, these figures only cover the workers employed in registered establishments in the urban area of China. Self-employment workers and workers in un-registered establishments are excluded from the figures below.

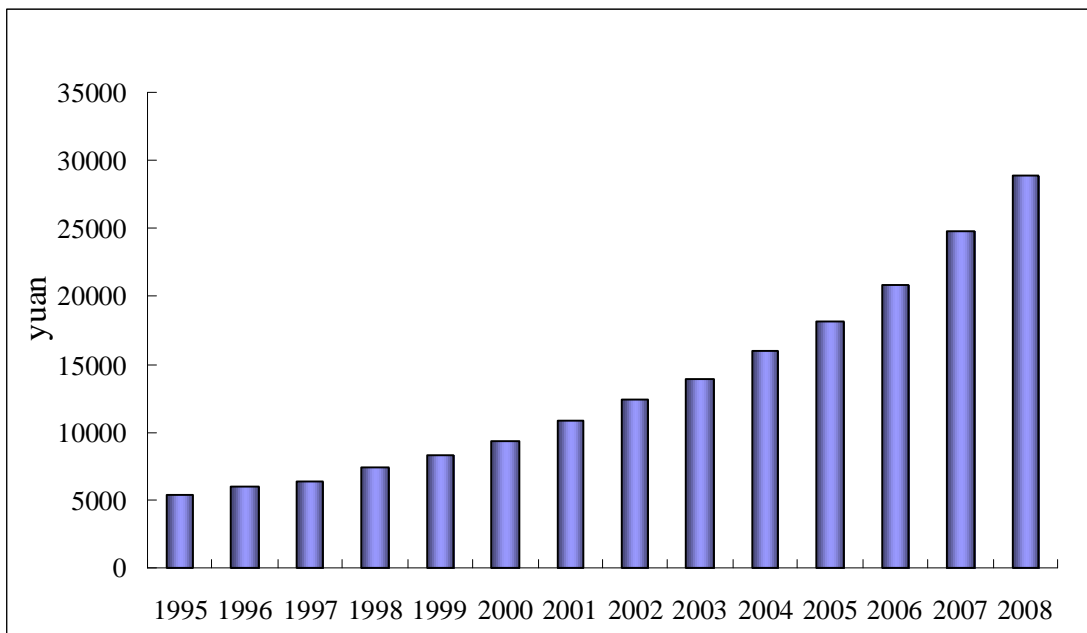


Figure 2.3 Average Real Urban Annual Earnings (yuan)

On the other hand, Zhang, Yang, and Wang (2010) use a long-term data from 1993 to 2007 on rural wages in six provinces, and discover that the real wages both in the peak and slack seasons in rural China have begun to rise substantially since 2003. One possible

reason for the rising rural wage is that since 2003, the government has implemented many public policies favoring rural development, including the abolition of agricultural taxes, the provision of subsidies for purchasing agricultural machines or equipment, the accelerated development of rural public services, increased investment in rural infrastructure and the provision of small loans to rural households (Ash, 2010).

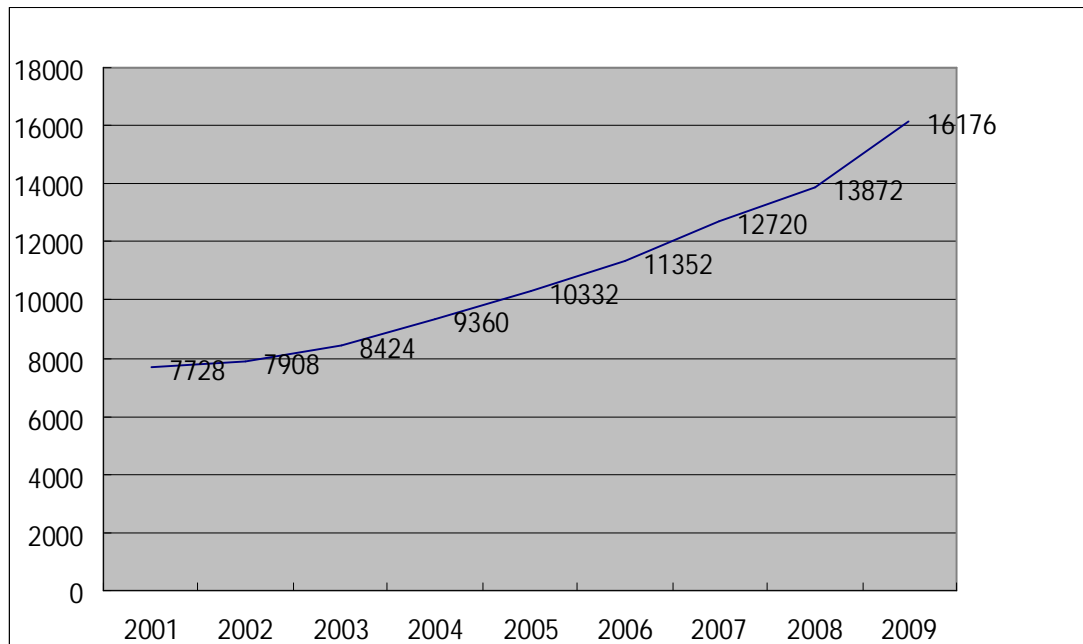
However, few existing studies have compared the rural and urban wages, in large part because the nation-wide wage data in rural sector is not available (Zhang, 2010). In order to make this comparison, I employ the labor income as a proxy for wages and calculated the average real annual labor income for urban sector and rural sector respectively, by virtue of utilizing the data from *Chinese Statistics Yearbook* in various years. Labor income comprises wages and supplementary labor income and is defined as all compensation paid to workers. The following table demonstrates the results.

Table 2.1 Average Real Annual Labor Income (yuan)

Year	Rural	Urban	Ratio(U/R)
1995	2766	5348	1.93
2000	3723	9333	2.51
2005	5003	18200	3.64
2007	6323	24721	3.91
2008	7265	28898	3.98

The data above for rural workers comes from household surveys in the rural area, while the urban data only covers workers in registered establishments in the urban area of China, including state-owned enterprises, private firms, government agencies, and foreign-owned enterprises. Table 2.1 indicates that the average real annual labor income in urban areas is approximately four times as high as the counterpart in rural areas in 2008. Since the supplementary labor income still plays a small role in the total compensation, I use the labor income as a proxy for wages. Therefore, I can cautiously conclude that the average urban wage is roughly four times as high as the average rural wage.

Moreover, within the urban sector, after a long stagnation of rural migrants' wage in the previous decade, the latest change is that rural migrants' wage started to rise. Based on surveys for migrant population, Figure 2.4 indicates that rural migrants earned twice in 2009 as much as they earned ten years ago.



Sources: National bureau of Statistics for 2001-6; Ministry of Agriculture (2010) for 2007-9.

Figure 2.4 Rural Migrants' Real Annual Earnings (yuan)

However, even in 2008, the average earning of rural migrants in cities was only 13,872 yuan, which is much lower than the average urban income in the same year, i.e. 29,229 yuan. Table 2.2 makes a comparison between the average urban annual earnings and annual earnings for migrants from rural areas from 2005 to 2008, and the results imply that the gap in real earnings between rural migrants and urban residents has been indeed widening.

Table 2.2 Rural Migrants' Wages and Average Urban Wage

Year	Real Annual Earnings (yuan)			
	Average Urban Sector (1)	Rural Migrants (2)	Gap (1)-(2)	Ratio (1)/(2)
2005	18200	10332	7868	1.76
2006	20856	11352	9504	1.83
2007	24721	12720	12001	1.94
2008	28898	13872	15026	2.08

2.2.3 Household registration system (*hukou*)

Workers with different *hukou* face different costs of living in cities and have different access to government-provided public service and welfare programs in the urban area.

In China, the most often cited labor market intervention is the continued enforcement of the household registration system (*hukou*), which was designed to strictly limit labor mobility within China. This section attempts to summarize the main aspects of current *hukou* system from labor economists' point of view in order to uncover what role the

hukou system plays in the current Chinese labor market.

The restrictions on labor mobility within China regulated by the *hukou* system have been relaxed significantly. At present, Chinese workers are free to move and work in any place within China. Accordingly, any internal migration is legal regardless of a worker's *hukou* status. The *hukou* system has lost its significance on strictly prohibiting Chinese workers from migrating to places different from where they were born.

However, although internal migration is not forbidden, the current *hukou* system assigns different benefits and costs associated with migration based on people's *hukou* statuses. For instance, although workers are allowed to migrate to any place, their children may not be able to attend public schools in the new place. Therefore, the *hukou* policy still has a large effect on influencing people's migration decisions.

2.2.3.1 What is the *hukou* system?

Hukou means household registration system in China. The current *hukou* system in China is very complicated. Since the late 1980s, China has devolved the power of the *hukou* management and *hukou*-related policy-making from central government to local governments (cities and towns) (Chan, 2010). Thus, local governments have now received full power and discretion to make their own *hukou* policies within their

administrative jurisdictions. As a consequence, *hukou*-related policies may vary substantially from one place to another. Given the complexity of the current *hukou* system and the enormity of the information accumulated on this subject, I will focus on the central elements of the current *hukou* system that labor economists are most interested in, leaving out unnecessary details and other possible digressions.

All Chinese nationals' personal *hukou* is categorized according to two classifications: one by *hukou* type and the other by *hukou* location.

(1) *Hukou* type.

The *hukou* “type” or “nature” is differentiated into “agricultural” and “non-agricultural” *hukou*. In January 1958, the central government issued the Regulations of *Hukou* Registration which required that each person born in China should be classified either agriculture *hukou* or non-agriculture *hukou*. Since the early 1960s, this distinction between agricultural and non-agricultural status defined one's relationship with the state and eligibility for an array of state-provided welfare (Chan, 2009). Non-agricultural status entitled the bearer to state-provided housing, employment, grain rations, education, and access to medical care as well as other benefits, which were not available to agricultural *hukou* holders (Cheng and Selden, 1994). The *hukou* type originated from the occupational division in China's economy in the 1950s, but as the system evolved, the

“agricultural” and “nonagricultural” distinction bore no necessary relationship to the actual occupations of the holders.

Currently, the most important determinant of a person’s *hukou* type when the person was born is parental *hukou* types. If both of a couple hold agricultural *hukou*, their children would be automatically admitted as agricultural *hukou*. That is, children of both parents with agricultural *hukou*, even if physically born in the city, are still granted agricultural *hukou* (Chan, 2010). If the couple differs in terms of *hukou* type, their children can freely choose between agricultural or non-agricultural *hukou*.

Sometimes the agricultural and non-agricultural *hukous* are referred to as rural and urban *hukous*, respectively (Knight, Deng and Li, 2010; Naughton, 2007). Nonetheless, we should keep in mind that “rural” and “urban” here are not referring to a person’s current physical location, whereas they are synonyms of the agricultural and non-agricultural *hukou*, respectively. Due to a considerable amount of labor mobility in current China, it is imprudent to judge a person’s physical location by *hukou* type, i.e. agricultural or non-agricultural *hukou* status. Table 2.3 illustrates the possible mixtures. As can be seen, cities¹ have both non-agricultural and agricultural *hukou* populations residing within them and, similarly, agricultural *hukou* population may exist in the rural areas or in the cities. With China’s complicated *hukou* system, the fine differences in the

¹ Cities and urban areas are synonyms throughout the dissertation.

terminology of *hukou* classification— especially after translation – can easily be overlooked, leading to confusion and misunderstanding. For an accurate understanding of China’s current *hukou* system, it is essential to differentiate these terms carefully.

Table 2.3 Population Groups by *Hukou* Type and Actual Location

	Agricultural <i>Hukou</i>	Non-agricultural <i>Hukou</i>
Urban Areas	Rural Migrants and Their Dependents	Urban Permanent Residents Urban-Urban Migrants
Rural Areas	Agriculture Workers	Some Workers in TVEs*

*TVEs refer to township and village enterprises.

Starting from the early 2000s, some regions and cities (e.g., Zhejiang, Shijiazhuang), have implemented experimental *hukou* reforms, making it easy for rural residents to obtain a non-agricultural *hukou*. To date, the distinction between agricultural *hukou* and non-agricultural *hukou* has been removed in 13 of 31 provinces in China, such as Guangdong, Zhejiang, Guangxi, Shanghai, Hebei, Jiangsu, etc, of which the majority are located in eastern China. That is, these provinces have abolished the “agricultural” and “non-agricultural” *hukou* distinction within individual jurisdictions.

(2) *Hukou* location

In addition to the *hukou* type, each person is also categorized according to his or her place of *hukou* registration. This is the individual's official and only "permanent" residence (Chan, 2009). Similar to *hukou* type, under the current *hukou* system, a person's residential location of *hukou* when born is also determined by parental *hukou* locations. If both of the parents hold a *hukou* in city A, then their children would be admitted as a local *hukou* specific to city A. If parents differ in terms of *hukou* locations, then their children can freely choose *hukou* location the same as either their father's or mother's.

In other words, in addition to the *hukou* type described above, each person is also distinguished by whether he has local *hukou* or non-local *hukou* with respect to an administrative unit (such as city or town). The local *hukou* registration defined one's rights to pursue many activities and eligibility for services in a specific locality. Because labor mobility was very rare before 1980, almost all people actually remained where they were "supposed" to be. The number of people residing in a location different from the place of *hukou* registration was quite small. However, in current China, labor mobility is so widespread that non-local *hukou* holders account for a significant proportion of total population in urban areas, especially in big cities, such as Beijing and Shanghai.

Since there are two classifications of *hukou* status in current China, in most cities there exist four types of people, excluding foreign nationals, based on the dual classifications of *hukou* above. Table 2.4 illustrates the four possible *hukou* statuses in a given administrative unit.

Table 2.4 Four Types of *Hukou* Status

	Agricultural <i>Hukou</i>	Non-agricultural <i>Hukou</i>
Living in a place the same as <i>hukou</i> location	Local Agricultural <i>Hukou</i>	Local Non-agricultural <i>Hukou</i>
Living in a place different from <i>hukou</i> location	Non-Local Agricultural <i>Hukou</i>	Non-Local Non-Agricultural <i>Hukou</i>

The distinction between *hukou* type and *hukou* location is crucial for understanding current *hukou* system in China, because policy changes to the *hukou* system will have differential impacts on people with different *hukou* statuses based on the dual classifications. To clarify this point, we use Beijing (as one “local” place) city to provide an illustrative example of these four types of people. First, those holding local (Beijing) and non-agricultural *hukou* are mostly called Beijing permanent residents, or urban

residents for short. Second, those holding local and agricultural *hukou* are migrants coming from Beijing rural area and are thus called rural residents. Third, those holding non-local (non-Beijing) and non-agricultural *hukou* are mostly migrants from other cities and are commonly called urban migrants. Finally, those holding non-local and agricultural *hukou* are named as rural migrants. In the past two decades, the majority of migrating population are people with agricultural *hukou* going into other cities, falling into the final category. Table 2.5 displays the definitions for these groups, and these definitions will be used consistently throughout the paper.

Table 2.5 Definitions of Four Types of Workers in a Given City

Group Name	<i>Hukou</i> Status
Urban Residents	Local Non-agricultural <i>Hukou</i>
Rural Residents	Local Agricultural <i>Hukou</i>
Urban Migrants	Non-Local Non-Agricultural <i>Hukou</i>
Rural Migrants	Non-Local Agricultural <i>Hukou</i>

2.2.3.2 *Hukou*-related public service and welfare benefits

The current *hukou* system is related to the access to a variety of public service and welfare programs, such as children education, medicare, housing subsidies, social security coverage, and so on (Li and Qiu, 2010; Li, 2010a; Yang, 2006). In current China,

most of public service and welfare benefits are attached to a person's *hukou* status, rather than the physical location. One can physically move to a new place but can be permanently barred access to local services and welfare programs. People who have moved to a new place but do not possess local *hukou* are usually called “floating” population. Conceptually, this is the group that has moved away from the location where their *hukou* is registered. Although the right of the police to expel migrants was abolished in 2003, *hukou* status still matters to a great extent with regards to the accessibility to welfare programs and public service.

Again, we need to keep in mind the two classifications of *hukou* status when examining the *hukou*-related benefits. In terms of agricultural *hukou*, the most important benefit associated with it is the land-use rights. In most places, a person with agricultural *hukou* will be automatically allocated a piece of land. However, the ownership of land belongs to the state, which means people can only use the land but cannot sell it or rent it out. Recently, the Chinese government issued a document to allow farmers to “transfer the right to operate on contracted land in the form of sub-contracting, leasing out, swap, transfer, shareholder cooperation, etc.” (Ash 2009). This initiative appeared to sanction the right of farmers to rent out their land to others, including companies. As a consequence, several provinces have initiated some experimental reforms on land renting, and now allow people to rent out their land for a short time period. However, in

present-day China land rental arrangements are generally informal, short term, and between households living in the same village (Feng et al., 2010; Jin and Deininger, 2009). In addition to the land-use rights, agricultural *hukou* holders can currently have access to agriculture subsidies and some kinds of social security programs due to the policy changes favoring rural areas which have been carried out in recent years. In spite of increasing benefits associated with agricultural *hukou*, only a few people are actually willing to pursue the agricultural *hukou* because the benefit related to non-agricultural *hukou* is still larger in most places.

On the other hand, in terms of the benefits of non-agricultural *hukou*, we have to take into account the *hukou* location which matters substantially. Hence, I will investigate the benefits associated with non-agricultural *hukou* in small cities and big cities separately.

As stated before, having a local *hukou* in small cities is associated with very few welfare benefits. Most of good schools and hospitals in China are located in large cities. Even though a person does not have a local *hukou* in a small city, his or her children can still go to public schools in this city and only bears a small amount of additional fees. Moreover, small cities usually have few generous social welfare programs, such as housing subsidies or minimum living guarantee. In sum, *hukou*-related welfare benefits are very limited in small cities, which is the main reason why local *hukou* in these cities

is less desirable.

On the contrary, possessing a *hukou* in a big city is accompanied by a great number of welfare benefits and public services, including housing subsidies, children education, social security programs, and so forth. A large proportion of migrants and their children cannot enjoy welfare benefits as urban residents do.

(1) Housing

Nowadays, the housing prices in China's big cities are surprisingly high. In order to avoid the housing prices to continue to sky-rocket, the governments of more than thirty big cities have implemented a policy called "restricted transaction" since January 2011, which basically means that people without a local *hukou* in these big cities cannot buy a new house there. For instance, people without Beijing *hukou* are no longer permitted to purchase a house in Beijing city unless they have had formal jobs (defined by the coverage of social security programs) in Beijing for more than five consecutive years. As a consequence, most people without Beijing *hukou* are not able to own a new house no matter whether or not they already have a house in Beijing.

In addition to the right to buy a house, low-income local *hukou* holders in big cities can enjoy generous housing subsidies. They can either rent a house at a low price or buy a

small house at a rate at least 30% lower than the market price (Li et al., 2010; Stephens, 2010).

(2) Children education

In terms of education for migrant children, a major policy document issued by the State Council in May 2001 stipulated that local governments take up the responsibility of providing nine-year compulsory education for migrants' children through the public school system. However, the enforcement is very weak in big cities. In fact, few local governments have actually implemented this policy of accommodating migrant children in public schools (Chan and Buckingham, 2008).

It appears that there has been progress in a few big cities in the past several years in terms of permission of migrants' children to public schools, such as Beijing and Shenzhen. But many serious problems still remain. Currently, in the majority of big cities, children with local *hukou* can receive nine-year mandatory schooling in public schools at a very low cost, whereas migrant children often have to pay a school fee several times that of local residents (Chen and Yang, 2010). As Liu and Zheng (2008) said, on average, the school fees per child in the city nearly account for one third of a rural migrant's annual income.

(3) Social security programs

The social security system in China has three elements: social relief, social welfare, and social insurance. Social relief mainly refers to social assistance programs, such as minimum living guarantee, which is limited to residents with local urban hukou. Local residents whose family income is lower than a given threshold would be eligible for a fixed amount of income guarantee provided by the local government. Social welfare includes disability benefits, free access to parks and libraries for senior local residents, and so forth. Most of migrants without local *hukou* are not eligible for urban social relief and social welfare programs. They are only eligible for urban social insurance programs, including pension, medical, unemployment, work-related injury and maternity insurance.

Even though migrants now have access to social insurance programs in urban areas, local *hukou* holders and migrants whose *hukou* location is somewhere else usually have separate social insurance systems. For instance, Yang (2006) stated that young women in Beijing without a local *hukou* are not covered by maternity insurance, which is only applicable for local *hukou* holders.

Li and Qiu (2010) compared the pension systems between local residents and migrants in several big cities, and discovered two main differences. First, local *hukou* holders belong to an old-age insurance system which is a combination of pay-as-you-go

system and individual accounts. In this system, people can not only enjoy the accumulation of pension funds, they can also be provided a guaranteed amount of pension each month after retirement via pay-as-you-go system. In contrast, migrants without local *hukou* are only eligible for individual account system, similar to private insurance. Secondly, the amount of pension for local residents increases with the overall price level, that is, with adjustment for inflation. However, people without local *hukou* in these cities are not eligible for this adjustment.

To recapitulate, various welfare programs are linked to applicants' *hukou* location. Small cities usually have few generous social welfare programs, whereas having a local *hukou* in big cities of China can generate numerous monetary benefits, though the amount of the benefits may vary from place to place. However, most of rural migrants are working in big cities of China. A report from the Chinese government says that nearly 64% of rural migrants are working in big cities defined by population size (Zhang et al., 2010). These migrants have very limited access to local welfare programs.

2.2.3.3 How can a person change the *hukou* status in current China?

I close this section by introducing ways in which an individual's *hukou* status might be changed. One's *hukou* status would remain unchanged no matter where the individual physically moved, unless he or she goes through a formal procedure of *hukou* conversion.

Since there are two classifications of *hukou* status, this section will explain the ways of *hukou* conversion based on the two classifications.

(1) *Hukou* type

As mentioned in the above section, recent *hukou* reforms have made the *hukou* type lose much of its substantive and symbolic significance. Thirteen provinces have eliminated the distinction between agricultural and non-agricultural *hukou* within their jurisdictions. Consequently, people whose *hukou* location are in these provinces have the same *hukou* type. In addition, several other provinces are also beginning to eliminate the distinction in *hukou* type in some cities and most towns.

In places where the distinction between agricultural and non-agricultural *hukou* still exists, obtaining a non-agricultural *hukou* has also become easier than before. For example, in most places, people can change the *hukou* type from agricultural *hukou* to non-agricultural *hukou* by obtaining a salary job in urban areas, being admitted to college or buying a house in cities (Chan and Buckingham, 2008). All in all, the conversion of *hukou* type has become less difficult due to recent *hukou* reforms since 2000.

However, in most places, there is notable opportunity cost of the conversion of *hukou* type that needs to be mentioned: those accepting a non-agricultural *hukou* in cities are

mostly required to give up their entitlement to land permanently in their home village, a potentially huge financial loss in some areas. In recent years, China has implemented various policies to promote rural development, such as agriculture subsidies and elimination of agriculture taxes. These policies have made agricultural *hukou* in some areas more attractive than before. Therefore, some agricultural *hukou* holders are reluctant to obtain non-agricultural *hukou* at the expense of giving up their land for ever. As a result, people who have an urban hukou still account for a small share of the total population. In 2009, the proportion of the population with non-agricultural *hukou* status, which all native urban residents hold, was 34 percent (Cai, 2011).

Li (2010b) conducted an empirical research to investigate the effect of the elimination of the distinction between agricultural *hukou* and non-agricultural *hukou* in eastern China on rural-urban migration. Using the difference-in difference approach, He found that for farmers with small piece of land, the policy effect is positive and statistically significant on their probability to migrate out, whereas for farmers with large piece of land, the effect is very small in magnitude and not significant. As it turns out, owing to rural development strategies, the opportunity cost of moving to cities to work is increasing for farmers.

Theoretically, there is another possibility of *hukou* conversion, from non-agricultural

to agricultural *hukou*. However, in reality, this case is rare due to the two reasons as below. One is that in most places, the conversion to agricultural *hukou* can only be done locally, that is, within an administrative jurisdiction. It is almost impossible for an urban worker in Gansu province (a relatively poor area in western China) to obtain an agricultural *hukou* in Beijing to take agriculture work. Secondly, even though some policies favoring agriculture work have been carried out, a majority of urban workers still prefer non-agriculture work and hence non-agricultural *hukou* due to the availability to better-pay urban jobs and already formed life style in urban areas. Thus, so far, very few people have chosen to change their *hukou* type from non-agricultural to agricultural *hukou* in practice.

(2) *Hukou* location

The ways to change *hukou* location vary significantly from place to place. As mentioned in the previous section, beginning in the late 1980s, China has gradually implemented various programs to devolve fiscal and administrative powers to lower-level governments. This trend has included changes in the management of the *hukou* system. Most local governments (cities and towns) now have full power to set their own local *hukou* admission criteria and the number of new local *hukou* they admit each year within their respective administrative jurisdictions.

Since there are no uniform criteria for *hukou* conversion in terms of *hukou* location across the whole country, I will analyze both small and big cities, respectively, in an attempt to capture the ways to change *hukou* location throughout the country.

Starting from 1997, *hukou* conversions to small cities and towns where state-provided welfare is minimal have been made much easier (Chan, 2009). A variety of policies have been put into effect to ease the *hukou* conversions to small cities. For example, some local governments admit local *hukou* to people who have salaried jobs or own a house in their administrative areas, or possess some types of occupational skills fitting the requirements stipulated by local governments (Chan and Buckingham, 2008). Despite the apparent ease of migrating to small cities and obtain a *hukou* in those cities under the initiatives in 1997, a small portion of people actually choose to do this since small cities tend not to attract migrants due to relative lack of job opportunities and less or almost no public service or welfare programs.

In contrast, as expected, many large cities where there are more government-provided benefits tend to put up the most stringent entry conditions to admit local *hukou*. For a sample of large cities, the destinations of tens of millions of migrants, such as Beijing, Shanghai, Guangzhou, Shenzhen and Nanjing, city governments grant local permanent *hukou* mostly to those who are very wealthy (for example, able to

purchase a top-end apartment in the market or make large investments to open a company in those cities) or highly educated (usually with a master degree or professional qualification), and to those who take very decent jobs in public sector or in big private companies, and to those make a big investment in a large city. For instance, taking Beijing as an example, people who make an investment in Beijing over five hundred thousand dollars can receive Beijing *hukou*. In Chongqing, migrant workers who have worked and undertaken business for a certain period of time, bought a house, invested, or who pay taxes of a certain amount are eligible to obtain local *hukou* status and to receive equal access to welfare benefits, such as social insurance, subsidized housing, education and medical care. In Guangdong, the government converts various criteria, such as schooling, working skills, contributions to social insurance, volunteering and blood donation, into credit points, which accumulate to help obtaining local urban *hukou* status (Cai, 2011). Thus, I conclude that the present *hukou* conversion policy in big cities is almost totally geared towards the super rich and the highly educated and is irrelevant to most of migrants. Rural migrants from poor areas, who account for the largest proportion of total migration, do not usually belong to any of the above categories. The strict requirements of *hukou* conversion are clearly beyond their reach. For example, if an ordinary worker from a poor area migrates to Beijing and takes a typist job, this worker will have almost no hope to obtain a Beijing *hukou*, no matter how long he or she stays in Beijing.

To summarize this section, although restrictions on internal migration within China have been gradually relaxed especially in the last decade, they have not been totally removed. The *hukou* system still has a large influence on the expected benefits and costs associated with migration behaviors, and thus remains the most significant policy affecting China's labor market.

2.2.4 Hukou-related labor market discrimination

Workers with rural hukou earn lower wages and are less likely to be hired in the high-wage sector in urban areas compared to workers with local urban hukou due to both differences in human capital and labor market discrimination.

2.2.4.1 Wage and hiring differentials

(1) Different wages

Although there are two classifications of *hukou* status, i.e., *hukou* type and location, respectively, most of previous research has not considered the separate effect of each classification. Rather, the vast majority of studies have compared the wages between rural migrants with non-local agricultural *hukou* and urban residents with local non-agricultural *hukou*. Chen and Huang (2010) reported the widening wage differential

between rural migrants and urban residents. Demurger et al. (2009) ran wage regressions controlling for observed characteristics, and concluded that the wage differential between rural migrants and urban residents cannot be fully explained by migrants' lower productivity. Park, Zhao, and Huang (2006) claimed that wage gap does not result solely from differentials in human capital attributes such as education, but is also clearly an outcome of the state's control over *hukou* status. Meng (2000) discovered that the huge wage gap between urban residents and rural migrants cannot be fully explained by individuals' productivity-related endowments. A significant part of the earnings differential is attributable to institutional job rationing in favor of permanent urban residents. Yao and Lai (2004) employed Blinder-Oaxaca decomposition approach and concluded that rural migrants in Zhejiang province earn 30% less than urban residents even controlling for observed characteristics, such as education and work experience. Deng (2007) used the China Household Income Project (CHIP) data which basically covers the whole country, and found that 60 per cent of the income differential between rural migrants and urban residents originates from unexplained factors. Wang (2005) conducted econometric analysis and claimed that 57% of the wage differential between rural migrants and urban residents can be explained by human capital variables after controlling occupation and industry, but the remaining 43% of the wage differential remain unexplained.

Since rural migrants differ from urban residents in both *hukou* type and location, it is hard to identify which *hukou* classification is the true source of the observed wage differentials from the above studies. Gravemeyer, Gries and Xue (2010) investigated the wage differential solely based on *hukou* type. They employed a Blinder–Oaxaca decomposition analysis to estimate the wage differential between workers with urban and rural *hukou* in Shenzhen city, and found that on average and all else being equal, 52.9 per cent of the higher wage of urban *hukou* holders is due to higher returns to the different characteristics and attributes, while 47 per cent is due to the higher endowments in characteristics such as education. This would imply that 52.9 per cent of the average wage difference between the two groups cannot be explained by observed characteristics related to productivity.

Liu (2010) employed a similar approach as above and obtained similar results using household surveys in 21 cities in Guangdong province in 2007. The sample in total covered 38,012 workers with four different *hukou* statuses. Liu compared the wages between urban migrants and rural migrants, and found that urban migrants earned much more than rural migrants and nearly 50% of this wage differential cannot be explained by human capital variables.

Gagnon et al (2011) compared three groups including urban residents, urban

migrants, and rural migrants using the Census data, and concluded that comparable workers with agricultural *hukou* earn much less than those with non-agricultural *hukou*. They found that urban migrants earn nearly 40% more than rural migrants, and furthermore, 40 percent of this income differential cannot be explained by observed characteristics. In contrast, by comparing urban migrants with urban residents, they discovered that urban migrants on average earn even more than urban residents after controlling for observed characteristics. Thus, they argued that *hukou*-based wage discrimination is only attributed to *hukou* type, rather than to *hukou* location.

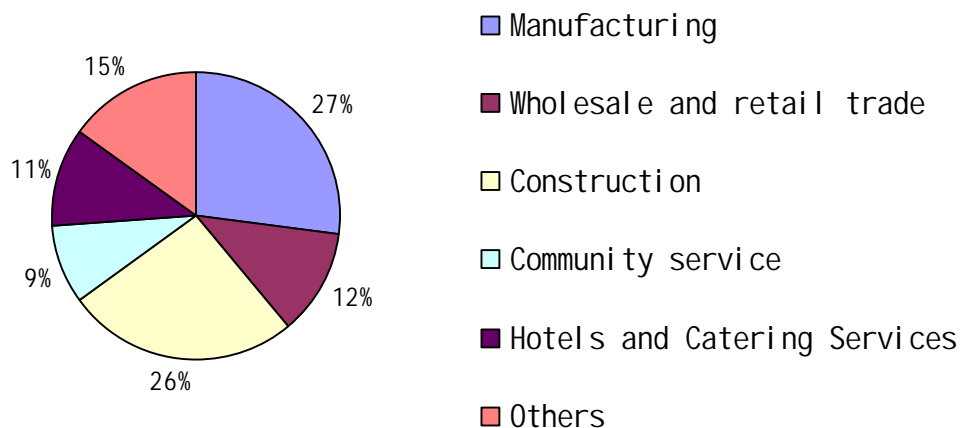
According to a sample survey conducted by the Guangdong provincial government in 2005, among the 10,000 workers with agricultural *hukou*, 57% believed the *hukou* system caused them to be paid less than urban workers even when they were in similar positions (Research Team of Guangdong Provincial Government, 2006).

(2) Different access to high-pay jobs

In China, deliberate exclusion for migrants in cities in terms of job access still remains in some high-pay sectors (Gagnon et al., 2011). Some job positions still require or prefer workers with local and non-agricultural *hukou*.

Chen and Hoy (2011) said that workers with rural *hukou* account for a very small

portion of workers in the high-wage SOE sector. This is in contrast with the private companies, where migrants outnumber local workers with urban hukou. Park, Zhao, and Huang (2006) measured the extent of occupational and sectoral segregation between local residents and rural migrants in urban areas of different provinces in multinomial logit models. They find that rural migrants are more likely to work in service industry and take manual jobs in private sector. In contrast, the majority of urban residents enjoy commercial and professional jobs. Zhao (2005) demonstrated that rural migrants find it difficult to gain access to formal jobs covered by social insurance programs due to their *hukou* status. The majority of migrants work in low-pay private firms. According to an official survey in 2005, most of rural migrants were working in low-pay industries, such as manufacturing and construction. The figure below displays the employment share in each industry for rural migrants in 2005.



Data source: Sun (2008)

Figure 2.5 Employment Share across Industries for Rural Migrants

Gagnon et al (2011) made a comparison of three groups with different *hukou* status to disentangle the respective effect of *hukou* type and location on job access. They said that there exists hiring discrimination against both rural *hukou* and non-local *hukou*. Compared with urban residents, urban migrants are 17 percent less likely to enter the formal sector defined by having formal labor contract, and more than 80 percent of this gap is unexplained and considered as discrimination based on *hukou* location. On the other hand, rural migrants are also nearly 17% less likely to enter formal sector than urban migrants, and about 50% of this difference is due to discrimination. Therefore, rural migrants are disadvantaged due to both *hukou* type and location.

As it turns out, although non-local *hukou* workers are not disadvantaged in terms of wage discrimination, they seem to face hiring discrimination with regards to access to high-pay jobs. Moreover, workers with non-local rural *hukou* face not only the discrimination against agricultural *hukou*, but also against non-local *hukou*. The double disadvantage makes rural migrants very difficult to find urban high-pay jobs.

2.2.4.2 Reasons for wage and hiring differentials

As shown in decomposition studies above, some proportion of the wage and hiring differentials between urban and rural *hukou* holders can be explained by observed

characteristics, such as human capital variables, whereas there is still an unexplained proportion most likely due to labor market discrimination

(1) Reasons for wage differentials

The portion of the wage that is not explained by productivity-related observed characteristics is commonly used as an estimate of the impact of labor market discrimination. Arrow (1973) defines labor market discrimination as the valuation in the market place of personal characteristics of the worker that are unrelated to worker productivity. Specifically, the wage discrimination means that two groups of workers who have the same productivity receive different wages (Becker, 1971; Aigner and Cain, 1977). Most of previous research on labor market discrimination that have been done in western countries focused on gender or race-based discrimination (Price and Wolfers, 2010; Blau and Kahn, 2000; Juhn, Murphy and Pierce, 1991). Most of previous studies argued that the wage differentials between observationally-equivalent workers with urban and rural hukou are due to wage discrimination (Gravemeyer et al., 2010; Xue and Gries, 2007). Li (2010a) claimed that rural migrants are discriminated against in the urban labor market and are regarded as “second class citizens” in urban society.

However, it should be noted that there could be another important reason for the wage differential. That is, the observationally-equivalent workers may not be truly

equivalent, while there may be some unobserved productivity differentials between the two types of workers responsible for the wage gap. These unobserved characteristics are known to the employers, but not known to the econometricians who run the wage regressions. Chen and Hoy (2011) conducted a comprehensive investigation of the underlying reasons for such observed wage differentials by utilizing a survey of both migrants and local workers in 21 manufacturing companies in Shanghai, and qualitative interviews with personnel managers in the surveyed companies. They found that many employers are concerned about migrants' high job mobility and instability, but low morale. Moreover, workers with rural hukou usually have their local accent, and sometimes have difficulties communicating with employers. A final disadvantage of employing migrants concerns migrants' accountability. For example, migrants have known to provide fake certificates of qualifications to obtain jobs. These unobserved characteristics related to productivity may explain some of the wage differentials found in econometric results.

The ideal way to prove the existence of discrimination and separate the effect of unobserved productivity is to conduct experiments or natural experiments. Unfortunately, since no empirical studies have been done in China on this topic using the experiment technique, it is impossible to rigorously prove the existence of wage discrimination against workers with rural hukou. Some of the factors that affect earnings, such as

motivation or work effort, cannot easily be quantified. Others (e.g., college major) are frequently unavailable in a particular dataset. Hence, in general, it is not possible to include all relevant job qualifications in a study of wage differentials between workers with different hukou. We have to acknowledge that the regression techniques have limitations on estimating the extent of wage discrimination.

Nonetheless, since most studies have found that in the urban areas, the wage differentials between workers with urban and rural hukou are around 50% after controlling for various observables, it is unlikely that the wage gaps found in all of the literature are solely due to unmeasured productivities. Moreover, several studies have included some additional control variables or target on homogenous groups to make the estimates more convincing and accurate. For example, Wang (2005) controlled for occupation and industry, and Zhang et al (2010) only focused on similar positions. Both of these studies find that around 50% of wage differentials between workers with urban and rural hukou cannot be explained by observed variables. Moreover, Liu (2010) compared the wages between urban migrants and rural migrants, and found that urban migrants earned much more than rural migrants and nearly 50% of this wage differential cannot be explained by human capital variables. These studies at least indicate some degree of wage discrimination in the urban areas.

According to results from Gagnon et al (2011), the wage differential between urban and rural hukou holders is much larger in the formal sector with written labor contract than in the informal sector without written labor contract. Controlling for observables, they found that urban hukou holders earn 15% more than rural hukou holders in the informal sector, but about 50% in the formal sector.

If any, why is there wage discrimination against rural *hukou* especially in the formal sector? The wage discrimination may arise from the fact that some employers in urban areas think that migrants, as a group, are low skilled and less reliable. Employers' negative perceptions are likely to be used as stereotypes to discriminate against migrants (Chen and Hoy, 2011). In addition, the employers in the SOE sector may have prejudice against rural hukou holders, which is similar to taste-based model of labor market discrimination. Since the seminal work of Becker (1971), economists have sought to understand how the tastes of employers, customers, or co-workers could result in labor market discrimination. Becker's original analysis of discrimination sought to explain how, in a competitive system, two groups with equivalent labor could be paid different wages. Zhang, Nyland, and Zhu (2010) claimed that workers with rural hukou tend to suffer from wage discrimination in the high-wage SOE sector because the SOE sector has distinct wage structures and HR policies for urban residents and rural migrants. That is, it is the employers in the SOE who discriminate against rural hukou holders.

(2) Reasons for hiring differentials

Ge (2007) argued that the observed differentials in hiring probability in the SOE sector indicate the existence of hiring discrimination against non-local rural hukou holders in this high wage sector.

Again, we need to be very cautious about interpreting the regression results. It is also possible that the differential in hiring probability is due to unobserved productivity. Chen and Hoy (2011) claimed that the employers in the SOE sector believe that rural migrants are less reliable. Therefore, some positions that are relevant to money management such as accountant, cashier, and financial officer usually require or at least prefer local hukou holders. Moreover, employers may believe that local workers have more social networks in local areas, and these networks may help firms to extend their business in the SOE sector. These unobserved differentials may be partly responsible for the hiring differential observed in empirical literature.

However, it is unlikely that all of the hiring differentials found in previous studies are only attributed to unmeasured characteristics. It is very plausible that there exists some degree of hiring discrimination against non-local rural hukou in the SOE sector.

Hiring discrimination is defined as workers with the same level of productivity have different access to the same jobs (Bertrand and Mullainathan, 2004). One excellent paper by Bertrand and Mullainathan (2004) identified the race-based hiring discrimination in the US. By sending fictitious resumes to US firms, they found out that white-sounding names received 50% more call-backs than African American ones.

If any, why is there hiring discrimination against certain *hukou* status? In my opinion, the answers in previous studies to this question are mostly misleading. A vast majority of previous literature argued that the main reason for the hiring discrimination was that urban governments had implemented policies such as occupation reservation for local residents in order to protect local workers. That is, the discrimination was caused by government policies favoring local residents. It is the government rather than employers that discriminates against non-local workers. For instance, Shen and Zhang (2010) said that “according to labor regulations in Shanghai city, firms in Shanghai have to give priority to local residents when making hiring decisions. Rural migrants with agricultural *hukou* could be hired only if local workers are not enough to fill in the vacancies. More than this, rural migrants are not allowed to take jobs in almost 20 industries including finance and insurance, government agencies, and high-technology industry. Similar regulations exist in some other cities, such as Wuhan in Hubei province, in which rural migrants cannot take positions in management and other professional work”.

Zhang et al (2010) said that governments in most of big cities set three different kinds of jobs: (1) jobs that are not accessible to certain *hukou* status; (2) jobs that should give priority to certain *hukou* status; (3) *Hukou* status does not matter. These three categories of jobs were ranked roughly by skills. For the last category of jobs that need low skills, all people had the same probability to be hired regardless of their hukou status. These policies had made firms treat workers differently with different *hukou* status when making hiring decisions. Workers with local non-agricultural *hukou* were assigned priority to receive good job offers. The government discrimination reduced the probability of getting a job in high-pay industries for migrants without local hukou, even though the migrants were able to perform jobs equally well in high-pay industries.

As we know, the most widely-recognized theories of labor market discrimination are taste model, model of statistical discrimination, and crowding model (Becker, 1971; Cain, 1986). Previous literature claimed that the empirical evidence on the hiring discrimination against workers with agricultural hukou is broadly consistent with the “crowding” model, in which some groups of workers are restricted to particular job markets and thus may be crowded into lower paying occupations. The crowding hypothesis has been proposed that as a result of discrimination in employment, some workers are crowded into certain occupations because of the refusal of most employers to

consider hiring them for jobs in other occupations (Bergmann, 1971). Crowding models of the labor market have been applied most frequently as an explanation for the discrimination generated by occupational segregation (Higgs, 1977; Hirsch and Schumacher, 1992). The following two figures illustrate how the wage gap is probably generated for comparable workers with different *hukou* type.

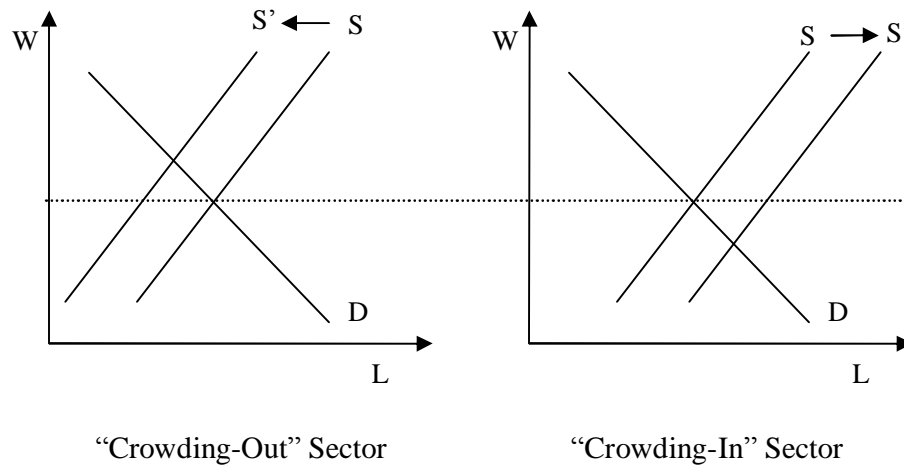


Figure 2.6 Crowding Model of Labor Market Discrimination

Figure 2.6 illustrates the crowding model of labor market discrimination. Assuming that without discrimination, the two sectors have the same wage. Since the government regulations prevent some workers with “bad” hukou (non-local or agricultural hukou) from entering certain jobs, these workers are crowded out, which generates high-pay sector and low-pay sector. The discrimination makes comparable workers with “good” hukou earn more but those with “bad” hukou earn less, generating the wage differential between comparable workers with different hukou statuses.

Nevertheless, these explanations for hiring discrimination have been out-dated. In fact, all of these kinds of discriminatory regulations mentioned above had been eliminated since 2004 (Chen and Hoy, 2011). Therefore, the discrimination found in recent literature should not be initiated by local governments. Rather, the employers in the SOE sector are discriminating against workers with non-local rural hukou.

Based on interviews with employers, I think the following reason is mainly responsible for the hiring discrimination we observe in the current Chinese labor market. Employers in the SOE sector have prejudice against non-local workers because they think that as a group, are characterized by low education, less accountability and stability. Due to these prejudiced taste, the SOE sector is not willing to hire migrants even though they are observationally similar to local residents. Moreover, since the SOE sector is commonly thought as part of government, the political power helps the SOE sector afford the discrimination against workers without local urban hukou.

For high-skill positions, there may be another reason for the hiring discrimination. When non-local hukou holders with high skill level search for high-pay jobs in the SOE sector, they also intend to change their hukou status to the local hukou after getting the job. Thus, employers who hire non-local hukou workers may have to take initiatives to

apply for local hukou quotas from the government. This application process usually takes much time and some financial cost, which makes employers in the SOE sector not willing to hire some migrants even though they are high skilled. That is, high-skilled workers with local hukou would possibly be hired preferentially compared to non-local hukou workers with identical skills.

To recapitulate, on average, urban hukou holders earn more than rural hukou holders in urban areas, and are more likely to be hired in the high-wage sector, such as state-owned enterprises. The differences in productivity-related characteristics cannot fully explain these wage and hiring differentials, so it is very likely there exists both wage and hiring discrimination against rural hukou holders in the urban labor market. The main reason for possible discrimination is that in some high-pay sectors, employers' negative perceptions on migrants make them generate some prejudice in favor of local residents. Furthermore, the protection from the government enables them to afford some degree of labor market discrimination. I will look further into this issue in Chapter 3 of this dissertation.

2.2.5 Simultaneous urban labor shortage and rural labor surplus

The phenomena of urban labor shortage and rural labor surplus are co-existent in the current Chinese labor market.

In the terminology of labor economics, the labor shortage refers to the situation where the quantity of labor demanded exceeds the quantity of labor supplied at the wage lower than market-clearing level. As early as in 2003, a shortage of workers occurred in coastal region of China. The labor shortage was first noticed when many firms reported that they cannot hire enough workers as they want, and fewer migrants from the countryside arrived to look for urban jobs after Chinese New Year in February 2004.

As time has gone by, the phenomenon of labor shortages has not disappeared but has spread to the Yangtze River Delta region, and even to provinces in central China, from which migrant laborers are generally sent out (Cai and Wang, 2010). Since the early months of 2010, Chinese factories in a few coastal cities have been struggling to find workers to help satisfy export orders. In July 2010, the media reported that factories in Guangdong have even hired many workers from Vietnam and elsewhere (Chan, 2010).

In contrast, there is still evidence of a substantial pool of surplus labor available in rural China (Knight, Deng, and Li, 2010; Kwan, 2009; Minami and Ma, 2009; Green, 2008). In Chinese context, most scholars either explicitly or implicitly, refer to rural labor surplus as a situation in which the marginal product of labor is very low and almost equal to zero (Knight et al., 2010; Chan, 2010; Garnaut, 2010; Yao and Zhang, 2010; Minami

and Ma, 2009). The labor surplus in this context is also called hidden unemployment or disguised unemployment in some literature. As Basu (1987) defined, broadly speaking, an economy is said to have surplus labor or disguised unemployment if it is possible to remove a part of its employed labor force without causing a fall in aggregate output. When there is a zero marginal product of labor, withdrawal of a certain amount of the labor force will not reduce production. On the other hand, a positive marginal product of labor does not exclude the possibility of the existence of disguised unemployment. Withdrawal of farm labor under this situation would cause a decline in farm output unless the remaining farmers were willing to work harder and longer (Liu and Swanson, 1967). According to Cai (2007), there are 490 million rural laborers in China, of which close to 200 million are employed in non-agricultural work. With current agricultural production technology, 180 million rural laborers are needed to maintain the current level of agriculture output. Hence, there are approximately 110 million rural surplus of laborers with about 58 million under the age of 40. In other words, Cai claimed that if 110 million people working in agriculture sector migrate out to urban areas, the total agriculture output in China would not decrease. Chan (2010) agreed with Cai and argued that the current agriculture sector is overstaffed, and thus further rural-urban migration would not reduce the rural output in the short run.

The estimated number of rural surplus ranges from 100 million to 150 million in the

above studies, since they employed different datasets and methods. The Development Research Center of the State Council, in a 2007 survey covering 2749 villages claimed that nearly one-quarter of these villages reported having young workers who can be transferred out of agriculture. This remaining population is still, in absolute terms, a huge untapped labor pool.

How can we explain the co-existence of urban labor shortage and rural labor surplus? This issue has become a contentious topic in the current Chinese media. I propose two reasons to explain this phenomenon after investigating a considerable amount of previous literature.

2.2.5.1 Institutional constraints

There still exist substantial institutional constraints which create difficulties for migrants living in urban areas, and deter or prevent migrant workers from bringing their families with them (Knight, Deng, and Li, 2010). Currently, the *hukou* system is still the largest institutional constraint to prevent further migration from rural to urban areas even though migration to cities is not officially prohibited. As discussed in the previous section, the *hukou* system increases the costs of living in the city for rural hukou holders while decreasing the benefits associated with rural-to-urban migration. For instance, the migrants' children have to pay a very high fee to attend public schools in the destination

city. Migrants without a local *hukou* in big cities cannot enjoy welfare benefit, such as minimum living guarantee or housing subsidies. The government still provides urban residents with some subsidies and benefits which are not available to some of rural migrants. This reduces the expected benefits for potential migrants. Furthermore, a large amount of transaction costs for rural migrants should not be ignored, such as the disutility of being away from family, expensive food and other necessities, high price of urban housing (Zhao, 1999; Shi 2002).

In addition, perhaps more importantly, the *hukou* system creates hiring and wage discrimination against migrants and thus reduces their labor market opportunities. Comparable workers with agricultural *hukou* have a smaller probability to be hired in the high wage sector in urban areas than those with non-agricultural *hukou*. Furthermore, among observationally-equivalent people, those with agricultural *hukou* get paid less than those with non-agricultural *hukou in urban China*. These kinds of labor market discrimination decrease the expected wages of rural migrants and hence deter further migration. Shao et al (2007) maintained that the available jobs for migrants are usually Three D (dirty, dangerous and demeaning) occupations at the low end of wage scale.

These restrictions and interventions listed above make many rural workers reluctant to leave the village, especially when the wages for rural migrants in urban areas are not

high enough to attract these workers.

2.2.5.2 Skill difference

The co-existence of rural labor surplus and urban labor shortage can be partly attributed to structural reasons as well, such as skill-mismatch. Specifically speaking, remaining workers in rural areas may not be able to take some job vacancies in cities due to lack of necessary knowledge or skills.

Knight, Deng, and Li (2010) argued that most of remaining labor surplus in rural sector are unskilled workers, whereas labor shortage of skilled workers is more serious than that of unskilled workers in urban China. For example, some surveys indicate that a large number of potential migrants fail to migrate to cities because they do not possess necessary skills or years of schooling required by urban jobs (DeBrauw et al, 2002; Du, Park, and Wang, 2005). It is common for enterprises in cities to require a middle school degree (nine-year education) before even considering migrant job applicants. Nevertheless, 85% of the labor force working in rural agricultural sector has less than nine years of schooling (Dang, 2010). Guangdong, for example, reported job vacancies of about 750,000 in mid-2009, most of which were mainly in the skilled technician categories such as computer engineering technicians and mechanics, for which most rural migrants were not qualified (Chan, 2010). Yao (2010) asserted that China is trying to

upgrade their exports and thus the demand for skilled workers is increasing. He argued that there is a real shortage of skilled labor in China. The bulk of rural migrants, 60% or more, have only nine years of education, and people with technical diplomas are rare.

Another concrete example of the shortage of skilled workers comes from a recent survey in Yancheng City, Jiangsu Province in 2010. Among 17 companies covered by the survey, 15 of them faced a shortage of skilled workers. They found that most of job seekers did not possess such skills as firms demanded (Chen, Cui, and Xue, 2010). Moreover, Cai and Wang (2010) argued that many firms set an age limit in recruitment. Firms in urban areas prefer younger workers to older workers. Job-searchers over 40 years old without high education or skills are considered to be hard to find a high-pay job. Therefore, we need to take into account the heterogeneity of workers in terms of skill level to understand the co-existence of labor surplus in rural areas and labor shortage in cities.

2.2.6 Unemployment

Open unemployment is low in China and is mainly concentrated in cities of central and western China.

Most Chinese scholars claim that there is no rural open unemployment and thus open

unemployment is mainly in cities (Cai and Wang, 2010; Han and Zhang, 2010). In rural China, the *Household Responsibility System* (HRS) guarantees that everybody has his or her share of land, so it is a reasonable assumption that rural unemployment is as low as negligible since workers can easily work on a piece of land to have a job in agriculture sector. People may argue that there may be rural unemployment during slack seasons. However, Chen et al (2010) claimed that farming during busy seasons, part-time job during slack time becomes the best option for most peasants in China. Even for people staying in rural areas during the slack seasons, if they are not actively searching for jobs, they would not be counted as unemployed. The only effect of non-working in slack seasons is a reduction in labor participations rate, but not an increase in rural unemployment.

As discussed in the last section, the state sector reform was speeded up after the Congress held in September 1997, which encouraged the restructuring of small SOEs, and allowed inefficient firms to reduce employment or go bankrupt (Lu and Jiang, 2008). Since the watershed of 1997, the urban labor market has been reshaped with massive layoffs in state-owned companies. As a direct consequence of the massive layoffs in the state sector, the emergence of urban open unemployment became a policy concern for the first time in 1998. The official indicator of unemployment in China is so-called registered unemployment rate defined by the ratio of registered unemployment to the sum of

registered unemployment and registered employment, but it is widely believed to underestimate actual unemployment and therefore is questioned by domestic and international scholars (Yang and Gu, 2010; Solinger, 2001). During the time of massive layoffs of the public sector in 1998, most of the laid-off workers initially expected to return to work for their original companies when the state-owned companies recovered from profits loss. Therefore, at that time, many laid-off workers did not register themselves as unemployed in local government agencies. For example, between 1998 and 2000 when a large number of SOEs workers were laid off, the registered unemployment rate remained unchanged at 3.1 percent.

Currently, the registered unemployment only covers unemployed people who hold a local non-agricultural hukou, that is, the unemployed among local residents (Yang and Gu, 2010). Because registered unemployment does not cover migrants who are not working and actively seeking for jobs, this indicator fails to reflect the actual severity of urban unemployment. For instance, the registered unemployment rate in urban China was 4.2% in 2005, whereas the Census data in 2005 showed that the surveyed urban unemployment rate was 5.2%.

From 1996, some scholars have tried to estimate the unemployment rate based on different household surveys according to the ILO definition of unemployment. By ILO

definition, unemployment rate is the ratio of urban unemployment over urban labor force. Giles, Park, and Zhang (2005) shows that the surveyed unemployment rate rose from 4.5 percent in 1996 to 7.3 percent in 2002, indicating a rise in urban unemployment due to the policy changes.

Cai and Wang (2010) utilizes survey data from *China Population Statistical Yearbook* to estimate the unemployment rate since the state sector reform, and shows that urban unemployment rate rose steadily from 4.0 to 7.6 between 1995 to 2000. After reaching the peak of 7.6 percent in 2000, it actually tends to decline with fluctuations. This suggests that China may have turned the corner in resolving the unemployment problems of the millions of workers laid off during the process of public sector restructuring.

Table 2.6 provides the updated evidence for the evolution of urban unemployment rate in China. In the following table, registered unemployment rate is the official indicator for urban unemployment, equal to the number of unemployed people in cities who registered with the government agency divided by the sum of registered unemployment and urban registered employment. In contrast, surveyed unemployment rate is estimated based on nationwide household surveys and is defined as the ratio of urban unemployment over urban labor force. A more detailed discussion about the relationship between the registered unemployment and surveyed unemployment is

provided in the appendix.

Table 2.6 Urban Unemployment Rate (percent)

Year	Surveyed unemployment rate	Registered unemployment rate
1997	4.5	3.1
1998	6.3	3.1
1999	5.9	3.1
2000	7.6	3.1
2001	5.6	3.6
2002	6.1	4.0
2003	6.0	4.3
2004	5.8	4.2
2005	5.2	4.2
2006	N/A	4.1
2007	N/A	4.0
2008	N/A	4.2

Source: surveyed unemployment rates in various years are from Cai and Wang (2010) based on nation-wide household surveys from *China Population Statistical Yearbook*. Registered unemployment rates are from *Chinese Statistics Yearbook* in various years.

Since the registered unemployment rate published by Chinese Statistical Yearbook only takes into account those unemployed who are registered with local governments, the rates are lower than those suggested by household surveys on the unemployment rate (Dong et al., 2007; Giles et al., 2005; Hu and Sheng, 2007). Qin (2010) employed 2005 Census data to estimate urban unemployment and claimed that urban unemployment rate was around 7.4%. In addition, Han and Zhang (2010) used another dataset from household survey and found that urban unemployment rate was about 8% in 2006.

Ma and Wang (2011) found that the urban unemployment is mainly concentrated in

inland China. Using the Census data, they showed that the unemployment rate in coastal China is only around 3%, close to the frictional level of unemployment. In contrast, the unemployment rate is about 5-6% in central and western China. They argued that some institutional forces may be responsible for the existence of unemployment in inland China, such as minimum wage, whereas the private sector in coastal China pays almost the market-clearing wage leading to low unemployment. Furthermore, this study discovered that the unemployed in inland region are mostly local residents with urban hukou. The unemployment rate for rural migrants in inland areas is even lower than 3%.

Qin (2010) and Li (2007) both asserted that the main type of urban unemployment is structural unemployment concentrated in central and western China, particularly due to skill mismatch. Qin (2010) demonstrated that most of urban unemployed people receive less than nine years of schooling and have very few technical skills. On the demand side, as mentioned in the previous section, China has a labor shortage in skilled workers, especially technicians in coastal region, such as carpenters. The vocational and technical schools have been developed too slowly to satisfy the demand. The skill mismatch is the most salient reason for urban unemployment in China (Li, 2007).

The increasing college enrollment rate did not solve the problem of structural unemployment. After 1998, in order to improve high education, China has built many

new universities, and college enrolment rate has risen sharply. The figure below displays the increase in the number of college graduates since 2004. In 2010, there were 6.31 million college graduates, more than twice as many as the number of college graduates in 2004.

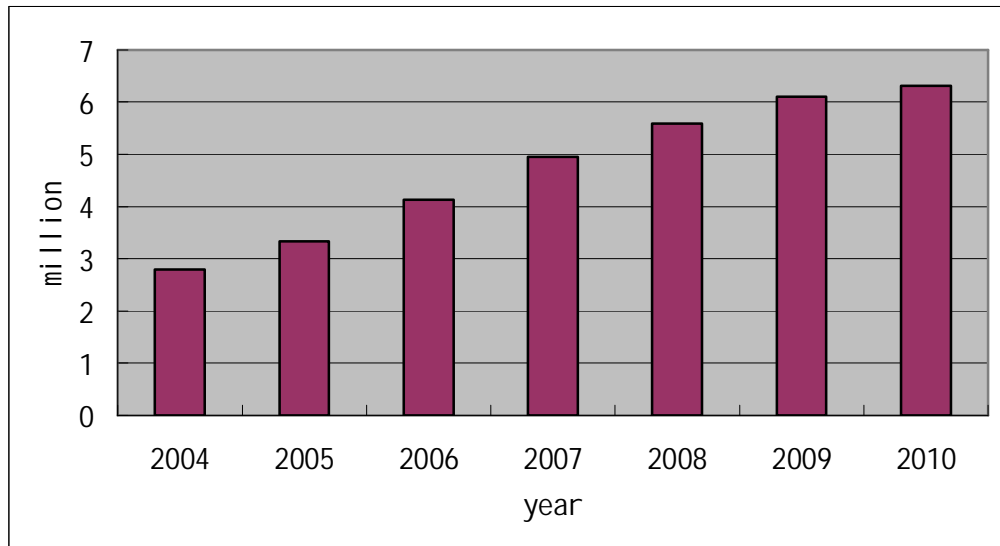


Figure 2.7 The Rising Number of College Graduates

However, China has paid too much attention to the quantity of colleges, but relatively little attention to the quality (Li and Chen, 2010). Nearly 30% of college graduates cannot find a job within one year after graduation. One reason is that the design of majors and courses in colleges was not responsive to the market demand, so numerous college graduates do not possess necessary skills the employers need. In addition, relatively low quality of some universities is also responsible for the low skills of college graduates.

Many universities lack good teachers and professors in some subjects. Therefore, even though the number of high degree holders has increased dramatically, the structural unemployment still prevails in urban China partly because of relatively low quality of education.

2.2.7 Labor Market Segmentation

There exists labor market segmentation between rural and urban labor market as well as within urban labor market between different ownerships

2.2.7.1 Segmentation between rural and urban labor market

The institutional constraints such as *hukou* system are still in place and causing segmentation between rural and urban labor market (Yang et al, 2010). Again, a labor market is said to be segmented if two conditions hold. First, for workers of a given skill category, some jobs are demonstrably better than others, most importantly, in terms of rate of pay, but also including other elements such as benefits, job security, or social protections. And second, the better jobs are rationed, in that only a fraction of those who would like these jobs and are capable of performing them are hired into them. As mentioned earlier, although restrictions on rural-urban migration have been relaxed gradually in the past decade, they have not been totally abolished. The hukou-based labor

market discrimination prevents many qualified workers being hired into high-pay jobs. Gan (2010) argued that the institutional obstacles still prevents some rural people from migrating to cities, and access to high-wage urban jobs is still limited for rural people due to *hukou* status.

Moreover, comparable workers earn more in urban area than in rural area. Shi (2002) discovered that urban labor earned 28% more than rural labor did after controlling for human capital variables. Dang (2010) employed a survey dataset and compared two groups with similar characteristics, and concluded that comparable workers earn more in urban sector than in rural sector. Yang (2010) also claimed that on average, workers with similar human capital earn around 80 percent more in cities than in rural areas.

2.2.7.2 Segmentation between different ownerships of firms

There is labor market segmentation between SOEs and private firms in urban China. In the urban labor market in China, state-owned enterprises (SOEs) still provides higher wages and benefits as well as better job security compared to non-SOEs (Song and Li, 2010; Knight and Song, 2005). Xue (2008) discovered that comparable workers earn 60% higher in state-owned companies than in non-state-owned companies after controlling for all of available observed characteristics. Zhang, Chen, and Wong (2011) found that the return on human capital is higher in SOEs since most of SOEs have some extent of

administrative power and provides more benefits for their own workers. Zhu (2010) claimed that SOEs pay the wages higher than market-clearing level, while the wages in non-SOEs are set at the market-clearing level.

Furthermore, the jobs in SOEs are strictly rationed, in that many workers in private enterprises who are willing and able to work in SOEs cannot find a job in SOEs (Demurger et al, 2008). In recent years, a considerable number of people applied for very few jobs vacancies in SOEs. I take a concrete example to illustrate this claim. In 2008, the four largest state-owned commercial banks in China created 1,200 job openings for college graduates. On the other hand, more than 12,000 college graduates applied for these 1,200 jobs. Thus, less than one tenth of college graduates were able to get a job in the four attractive state-owned banks in 2008.

2.2.8 Wage determination in the urban private sector

Wages in urban private sector are largely market-determined, and institutional interventions play a small role in wage-setting mechanism.

Several authors have identified labor market conditions in China as being largely market-determined, and claimed that labor market interventions play a small role in wage-setting mechanism in private sector (Dong and Xu, 2009; Ni, Wang, and Yao, 2011;

Zhang et al, 2011; Knight and Song, 2005). This conclusion is drawn based on apparent lack of institutional forces that push wages above market-clearing levels. The most common sources of labor policy interventions in terms wage-setting are minimum wage and labor unions. I examine these two kinds of interventions in more detail below to verify the largely market-determined wage setting mechanism in China.

2.2.8.1 Minimum wage

Minimum wage regulation was initially introduced in 1993, but new regulations were put in place in 2004 to cover part-time workers via a minimum hourly rate, and to increase the penalties for non-compliance (Baker & McKenzie, 2004). The minimum monthly wage is set on the assumption that the employee works a standard 40-hour week and the labor law specifies that extra hours should be paid at 150% of the normal hourly rate. Decisions to introduce a minimum wage and to determine its level are usually taken at prefecture level with reference to cost of living and other labor market conditions.

The minimum wage regulation fails to play an important role in Chinese labor market mainly due to two reasons: low level of the required minimum wage and weak enforcement. First, the minimum wage data provided by the Wage Division of the Ministry of Labor and Social Security suggests that in some cities, the minimum wages are still very low (Ni, Wang, and Yao, 2011). Second, while the minimum wage exists on

paper, there is little evidence that it is effectively enforced on the ground. Therefore, even for cities with higher-than-market-clearing minimum wage, the weak enforcement downplays the role of minimum wage regulation in affecting wage-setting mechanisms.

2.2.8.2 Labor unions

Zhang et al (2011) shows that trade unions in China do not play a significant role in affecting industrial labor income. The All-China Federation of Trade Unions (ACFTU) began to require the establishment of labor unions in private enterprises in 1995 (National Federation of Trade Unions, 1995). In order to explore a legitimate way to protect the rights and interests of workers, relevant policies were put into place in 1998. From 1998 to 2008, labor unions and union membership increased rapidly in China, especially in the private sector. Although the number of organizations and their members increased, Chinese labor unions failed to help workers in the bargaining process with employers, especially in terms of bargaining for higher wages. The most crucial reason is that there is no freedom of association for workers and all labor unions are under the All-China Federation of Trade Unions which is, indeed, a part of the government.

2.2.9 Return to education

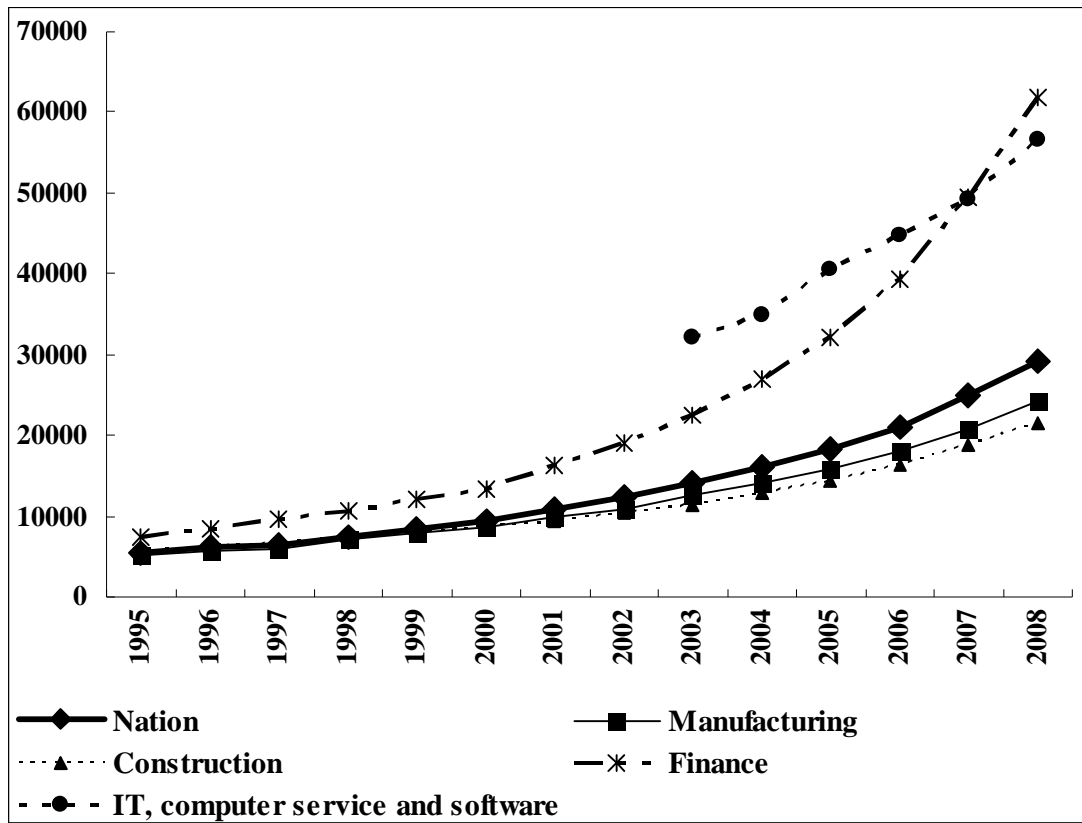
Skilled workers have experienced a much larger wage increase than unskilled

workers. Kang and Peng (2010) employed a CHNS (China Health and Nutrition Survey) dataset from 1991 to 2006 and discovered that the average wage differentials between college graduates and high school graduates have risen substantially. Since the wage data for workers with different skill levels is not available, several previous studies employ a proxy variable for the skill level. For example, Liu (2009) ranked different industries according to the proportion of high-educated labor in the labor forces, and calculated the industry-wide average wage rates. Then, Liu used the average wage in the industry with the highest percentage of college graduates to represent the wage of skilled workers. That is, the wage in the industry that requires a large portion of skilled workers reflects average wage of skilled laborers, whereas the wage in the industry that requires a large portion of unskilled workers serve as the proxy for the wage of unskilled workers. Specifically, Liu used the wage rate in the Scientific Research sector to represent the wage of skilled labor, and wage rate in the Manufacturing sector to represent the wage of unskilled labor, and defined “skill premium” as the wage rate ratio of skilled labor to unskilled labor. Using this approach, this study showed that the skill premium as defined above increased from 1.2 to 1.9 since 1987.

Yang, Chen, and Monarch (2010) followed the above approach to argue that rises in the wages of skilled labor, especially for those workers with high educational attainment employed in advanced service industries, have been the major force behind the dramatic

increases in the general wage level in China. They claimed that it is the sharp increase in the wages of skilled labor and the increasing share of the skilled labor in the total labor force that are the main thrust behind the overall wage rise pattern in China.

Using the same approach, the figure below which plots the evolution of yearly wage for different industries illustrates that skilled workers have experienced wage rise to a much greater extent than unskilled workers do.



Sources: Chinese Statistics Yearbook, various years

Figure 2.8 Evolution of Annual Earnings in Different Industries (yuan)

As can be seen, the upward movements in wages in sectors such as manufacturing, and construction which hire a substantial proportion of unskilled workers have been very limited, partly due to an increasing labor supply of unskilled workers induced by the rural-urban migration. In contrast, the average wages in the industries with a considerable number of high skilled workers such as finance and IT industry have rocketed in the past decade. This implies that the wage gap between skilled and unskilled workers has been enlarging.

These wage trends reflect the rise in rewards to skills (or education) during China's economic transition. The private return to education has risen dramatically after the reform of China's labor market. In pre-reform China there was very little return for education manifested in earnings. Cab drivers and college professors had similar incomes. Economic reform has created a labor market in which firms are free to make hiring decisions and workers are allowed to decide where they are willing to work. In the short period between 1988 and 2003, the Mincer wage returns for one additional year of schooling increased from 4% to 11% (Dollar, 2007).

Kang and Peng (2010) investigated the private returns to schooling in urban China using pooled CHNS (China Health and Nutrition Survey) dataset. Based on the standard Mincer human capital earning function, they adopted the OLS and IV models and

concluded that one additional year of schooling leads to wage increase by about 9%. Heckman and Li (2004) used the data from the China Urban Household Income and Expenditure Survey (CUHIES) to identify the returns to higher education for young people in the urban areas of the six provinces. The instruments employed are parental education and year of birth, and the IV estimator of average return to four-year college attendance was 43% (on average, 11% annually).

Drawing on data from urban household surveys in six provinces, a recent study by Zhang et al. (2005) provided estimates of the returns to education in urban China for each year from 1988 to 2001. Based on OLS estimation of the Mincerian earnings function, a dramatic increase in returns was reported, from only 4.0% per year of schooling in 1988 to 10.2% in 2001. Qian and Smyth (2008) estimated the private returns to education and discovered that, on average, an additional year of schooling would increase earnings by 12% in 2005.

Although the econometric results from OLS regression based on Mincer equation should be cautiously used due to possible omitted variable bias or endogeneity bias, the results from IV approach should be more convincing. According to the results from above studies, I conclude that the return to education has increasing sharply in the past two decades.

2.2.10 Self-employment and social insurance coverage

About 10 percent of urban labor force in China is self-employed, and a substantial share of wage and salary employees in urban areas is not covered by social insurance programs.

Self-employment is often referred to informal employment in previous literature. Using this definition, informal employment in urban China accounts for a very small portion of total urban employment. In 2005, nearly 10 percent of urban workers were reported as self-employed (Park and Cai, 2011). Zhu (2010) estimated that around 8% of urban workers are self-employed, and this proportion has been decreasing over the last several years. Giulietti et al. (2011) found that most of self-employed workers in the urban area are rural migrants. Among rural migrants in cities, around 20 percent are self-employed. They found that migrants choose self-employment not because they cannot find salaried jobs, but they are willing to pursue a business opportunity. The results of the analysis indicate that self-employed migrants earn on average 15% higher than those with salaried jobs with similar observed characteristics. The authors argue that the wage differential is mainly due to some unobserved characteristics, such as social networking, willingness to start a business, and so on.

Zhang and Zhao (2011) investigated in more detail about the determinants of self-employment and the wages of self-employed workers. They defined self-employment as the status of working for oneself instead of for an employer. A self-employed individual may work alone or own and run a business that also hires other people. These individuals can be scrap metal collectors, street vendors who sell fruits, snacks, cigarettes, clothing, souvenirs, etc, or provide services such as shining shoes and repairing bicycles and electronics. This study uses a unique survey database on Rural-Urban Migration in China and Indonesia (RUMiCI). The first wave of the survey was conducted in 2008 and the data became available in 2009. In China, three representative samples of households were surveyed, including a sample of 8,000 rural households, a sample of 5,000 rural-urban migrant households, and a sample of 5,000 urban households. In response to a survey question asking about the migrant's reason to choose self-employment, the top three answers are: (1) it brings a higher income (answered by 38 percent of the self-employed migrants); (2) it gives more flexibility and freedom (29 percent); and (3) it allows one to be one's own boss (19 percent). Only a small fraction (12 percent) ended up being self-employed because they cannot find wage work.

The paper introduced above used an IV approach and finds that a rural-urban migrant with a larger social-family network is more likely to be self-employed in the city. This

finding is robust to alternative model specifications and various restrictions on the sample used in estimation. After controlling for human capital variables and numbers of friends and relatives, the income differential between self-employed people and wage workers is close to zero.

The term “informality” has various meanings in different literature. Many previous studies have discussed informal employment in China, but they use the word differently. In addition to self-employment, there are at least two other possible definitions that have been used in academic studies.

Some scholars define a worker working informally if he or she does not have a formal labor contract. Labor contract is a binding agreement between employers and employees governing wages and benefits as well as working conditions. In China’s context, labor contract plays a crucial role in employment relations, in that it is basically the only binding document employees can use in the face of labor disputes. Without the written labor contract, employers can easily violate the agreement, such as withdrawing benefits employees should receive, deferring wage payments, or requiring overtime work without any additional compensation. The labor contract is intended to help employees to verify their argument in the case of arbitration or lawsuit. Due to the special importance of labor contract in China, most scholars have defined informal employment as lack of

written labor contract (Park and Cai, 2011; Gagnon et al., 2011).

According to this definition, informal employment has become less popular in urban China and nearly 90% urban workers now have a written labor contract, partly due to the implementation of the new Labor Contract Law. The new Labor Contract Law was implemented on Jan 1st, 2008, and re-affirmed the requirement that all employers sign formal contracts with their employees and both employers and employees participate in social insurance programs, strengthens rights to collective bargaining, and required extra payment for overtime work. The new law also laid down a revised, sharpened and much more detailed version of the employment protection rules, with strict procedural requirements to consult employees in the event of changes to work conditions and prescribes relatively high severance pay. According to the new law, employers who do not sign labor contracts with employees would pay very high fines. Therefore, the proportion of workers without a labor contract has decreased dramatically. Specifically speaking, by the end of 2007, only half of workers in urban areas held a written labor contract, whereas the percentage has increased to 88% by the end of 2009.

Additionally, some previous studies have considered social insurance coverage as the criterion for formal employment. Specifically speaking, a worker is working informally if he or she is not covered by any social insurance programs. In urban China, there are five

main types of social insurance programs, including pension, medical, unemployment, work-related injury and maternity insurance. According to this definition of informal employment, most rural migrants work informally, in that only one quarter of rural migrants in urban areas is covered by social insurance system (National bureau of Statistics, 2010). Li (2010a) found that indicate that in urban labor market, only 18 percent of migrant workers were covered by a pension scheme, less than 11 percent by unemployment insurance, and 10 percent by medical insurance in 2007.

Although the new labor contract law requires the adherence to social insurance system for both employers and employees, the enforcement to date has been very limited. The power of labor inspectors in government is constrained by the legal framework for administrative penalties. The possible punishments are very limited, and the amount of fines involved is too small to enforce the compliance (Herd and Reutersward, 2010). Thus, there is still a large proportion of urban workers not covered by social insurance system. Zhu (2010) showed that by the end of 2008, the coverage of social insurance system for urban workers is 68 percent for old-age pension, 79% for medical insurance, 54% for unemployment insurance, 59% for work-related injury insurance, and 44% for maternity insurance, respectively. As it turns out, there is still a large portion of laborers working informally characterized by no social insurance coverage. The transition from informal to formal employment has yet a long way to go. However, the new labor

contract law at least signals the willingness of government to promote formal employment with written labor contract and social insurance coverage.

To summarize this section, I conclude that no matter which definition we use for informal employment, either by self-employment, or by no labor contract or no social insurance coverage, informal employment in urban China has become less frequent.

2.3. Conclusion

Fifteen years ago, it was the government, rather than the market, that arranged the allocation of labor in China. The past fifteen years witnessed the rapid development of China's labor market. Since the mid-1990s, job-seekers have become free to choose jobs, and employers have more flexibility to make decisions on hiring and firing. Since then, the Chinese labor market started to burgeon, in which employers make hiring decisions to maximize profit while workers make labor supply decisions to maximize utility.

However, the current Chinese labor market has some unique features. It is unique not only because the current Chinese labor market is different from other countries' labor market, but also different from what it used to be fifteen years ago. Based on the preceding review of nearly 200 academic articles and books, I conclude that the current

Chinese labor market can be summarized by 10 features as follows.

1. Nearly half of total labor force in China is working in rural areas and the other half is working in urban China; Within rural areas, more than one half of the rural labor force is still working in agriculture sector, and the rest is working in rural non-agriculture sector concentrated in eastern China; Within urban labor force, more than three quarters are working in private sector.

2. Urban and rural wages have both been increasing in real terms, but urban wages have grown much faster than rural wages, and now the average urban wage is approximately four times as high as the average rural wage.

3. Urban and rural hukou holders face different costs of living in cities and have different access to government-provided public service and welfare programs in the urban area.

4. Workers with rural hukou earn lower wages and are less likely to be hired in the high-wage sector in urban areas compared to workers with local urban hukou due to both differences in human capital and labor market discrimination.

5. The phenomena of urban labor shortage and rural labor surplus are co-existent in the current Chinese labor market.

6. Open unemployment is low in China and is mainly concentrated in cities of central and western China.

7. There exists labor market segmentation between rural and urban labor market as well as within urban labor market between different ownerships

8. Wages in urban private sector are largely market-determined, and institutional interventions play a small role in wage-setting mechanism in urban private sector.

9. Skilled workers have experienced a much larger wage increase than unskilled workers.

10. About 10 percent of urban labor force in China is self-employed, and a substantial share of wage and salary employees in urban areas is not covered by social insurance programs.

Appendix:

Measures of Unemployment in China

I use the table below to demonstrate how the official unemployment rate (called registered unemployment rate) is measured in current China.

B	D
C	E
A	

The whole rectangle represents the total urban population. The definition of each area is given as follows.

$A+B+C+D+E$ =Total urban population.

A =Not in urban labor force.

$B+C+D+E$ =Urban labor force.

B =Registered unemployment with local urban hukou.

C =Unregistered unemployment.

$B+C$ =Urban unemployment

D =Registered employment in registered establishments

E=Unregistered employment

D+E=Urban employment

According to the ILO definition, urban unemployment rate should be equal to urban unemployment divided by urban labor force, that is, $\frac{B+C}{B+C+D+E}$.

However, the official unemployment rate published in China is so-called registered unemployment rate which is defined by the ratio of registered unemployment to the sum of registered unemployment and registered employment, i. e., $\frac{B}{B+D}$.

In the literature on the topic of China's unemployment, scholars have tried to estimate the true unemployment rate using the ILO definition, and these estimates are called surveyed unemployment rate based on nation-wide household surveys, such as Census.

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Chapter 3 Hukou-based Labor Market Discrimination and Ownership Structure in Urban China: Comparing OLS and Double-selectivity Estimates

3.1 Introduction

It has been reported that since 2003, Chinese factories in a few coastal cities have been facing a labor shortage in that firms have difficulty hiring enough workers as they want. As time goes by, the phenomenon of labor shortage has not disappeared but has spread to more cities. In July 2010, the media reported that factories in Guangdong have even hired many illegal workers from Vietnam and elsewhere (Chan, 2010). In contrast, we still observe hundreds of millions of people staying in the rural area and earning very low wage. Some scholars called the low-wage workers in the rural area as rural labor surplus (Knight et al., 2011). Why do these rural workers choose to work in the agriculture sector and earn very little rather than migrating to cities for better-paying jobs?

Previous studies have provided several reasons for the co-existence of urban labor shortage and rural labor surplus, such as credit market imperfection with costly migration, and the large amount of cost of living for rural-to-urban migrants in cities due to the

household registration system (*hukou*) (Chau et al., 2012; Knight et al., 2011). Nonetheless, there is another possible reason for this puzzle that most of previous studies have ignored: rural-to-urban migrants face labor market discrimination in cities due to their *hukou* status. In January 1958, the central government issued the Regulations of household Registration which required that each person born in China should be classified either rural *hukou* or urban *hukou* in a given location. This paper attempts to provide empirical evidence on the labor market discrimination against rural *hukou* holders in Chinese cities, so as to offer another explanation for the simultaneous urban labor shortage and rural labor surplus.

Specifically, this paper examines the extent of labor market discrimination against rural *hukou* holders in state-owned enterprises and private firms, respectively. Based on previous literature, the urban labor market in China is segmented involving state-owned enterprises (SOE) and private sector (Song and Li, 2010). As is known, state-owned enterprises (SOEs) still provide higher wages and benefits as well as better job security compared to private firms for political reasons, while the wages in private firms are largely determined by the market forces (Dong and Xu, 2009; Knight and Song, 2005). Therefore, the results of this study can help us better understand whether the *hukou*-based discrimination is driven by market behaviors or by institutional forces. To my knowledge, this paper is the first one to test the *hukou*-based discrimination in different ownership

sectors.

Moreover, this paper will distinguish two types of labor market discrimination against rural hukou holders, namely wage discrimination and hiring discrimination (also called employment discrimination). Wage discrimination is defined as the situation in which two groups of workers who have the same characteristics receive different wages (Becker, 1971; Aigner and Cain, 1977). The hiring discrimination here refers to the situation in which comparable workers with rural hukou are less likely to be hired in the high wage SOE sector. I will test the degree of both types of discrimination against rural hukou holders in urban China.

Another important methodological contribution of this study is to adopt a double-selectivity approach to account for selectivity both in sector and hukou status determination. The first selectivity comes from the possibility that stated-owned enterprises selectively hire people with certain characteristics. Another selection problem arises because local governments of Chinese cities can grant urban hukou to some rural hukou holders with certain characteristics who meet the criteria specified by each local government. In general, selectivity bias may arise when a model is applied to a non-random sub-sample of the underlying population. In our context, people who are working in the SOE sector and who have urban hukou are not drawn randomly from an

underlying population. As Beller and Blau (1988) argued, the adjustment for selectivity bias is important, particularly when one is interested in potential differences in employer treatment of two groups. In this case, the focus should be on wage offers rather than observed wages (Beller and Blau, 1988; Reimers, 1983). The selectivity issue of hukou status has never been dealt with or even considered in previous literature. This paper will be the first one to apply the double-selection framework to study labor market discrimination in China.

The structure of this paper is as follows. Section 2 provides some institutional background of the current Chinese labor market with particular attention on the labor market segmentation and the hukou system. In section 3 and 4, I will review previous literature and elaborate the contributions of this paper. Section 5 describes the methodology of studying wage and hiring discrimination in two ownership sectors and provides various model specifications. In section 6, I present the data description and report the econometrical results. Section 7 develops a theoretical discussion of our results and section 8 concludes.

3.2 Institutional background of the Chinese labor market

3.2.1 Labor market segmentation

China has the usual dimension of labor market segmentation – some jobs being much better than others, with not enough employment in the better job segments for all who would like these jobs and are capable of performing them. As many scholars have pointed out, the main feature of the current labor market in urban China is a segmented labor market involving state-owned enterprises and private enterprises (Song and Li, 2010; Knight and Song, 2005).

Specifically, state-owned enterprises (SOEs) still provide higher wages and benefits as well as better job security than private firms. Zhu (2010) argued that SOEs pay the wages higher than market-clearing level, while the wages in non-SOEs are set at the market-clearing level.

Furthermore, the jobs in SOEs are strictly rationed, in that many workers in private enterprises who are willing and able to work in SOEs cannot find a job in SOEs (Demurger et al., 2012). In recent years, a considerable number of people applied for very limited jobs vacancies in SOEs. Accordingly, even though many applicants possess the job qualifications, they could not obtain jobs in SOEs due to relatively fewer vacancies and intense competition.

3.2.2 Unique hukou system

In addition to the labor market segmentation, the current Chinese labor market has a unique household registration system (*hukou*).

Every Chinese citizen holds either an urban or rural *hukou* in a particular location. One's *hukou* status would remain unchanged no matter where the individual physically moved, unless he or she goes through a formal procedure of *hukou* conversion. The criteria to convert the *hukou* status from rural to urban vary from one place to another, since local governments have now received full power and discretion to make their own *hukou* policies within their administrative jurisdictions. Some local governments admit local urban *hukou* to people who have salaried jobs or own a house in their administrative areas, or possess some types of occupational skills fitting the requirements stipulated by local governments (Chan and Buckingham, 2008). In Guangdong, the government converts various criteria, such as schooling, working skills, contributions to social insurance, volunteering and blood donation, into credit points, which accumulate to help obtaining local urban *hukou* (Cai, 2011).

3.3 Past research on labor market discrimination against rural *hukou*

Most of previous studies have used the Blinder-Oaxaca decomposition technique to

conclude there is some degree of labor market discrimination against rural hukou in urban China. The basic idea of the Blinder-Oaxaca decomposition is that differences in average wages can be decomposed to differences in characteristics (sometimes called endowment) and differences in returns to these characteristics (also called coefficients). The latter is conventionally used as an estimate of discrimination (Oaxaca, 2007). Deng (2007) used the China Household Income Project (CHIP) data in 2002 which basically covers the whole country, found that 60 per cent of the wage differential between rural and urban hukou holders in cities originates from unexplained factors. Gravemeyer, Gries and Xue (2010) employed a Blinder-Oaxaca decomposition analysis to estimate the wage differential between workers with urban and rural hukou in Shenzhen city, and found that on average and all else being equal, 52.9 per cent of the higher wage of urban *hukou* holders is due to higher returns to the different characteristics and attributes, while 47 per cent is due to the higher endowments in characteristics such as education. This would imply that 52.9 percent of the average wage difference between the two groups cannot be explained by observed characteristics.

Nonetheless, very few studies have analyzed the discrimination in state-owned enterprises (SOE) and private firms separately. Chen and Hoy (2011) conducted a qualitative research on discriminatory behaviors in state-owned and private manufacturing companies in Shanghai, and argued that the wage discrimination is larger

in state-owned enterprises than in private sectors. However, they failed to provide quantitative evidence on the exact extent of labor market discrimination in two ownership sectors.

To my knowledge, only one previous study explored quantitatively the differential effects of hukou status on wages between different economic sectors. Gagnon *et al* (2011) utilized the Census data in 2005 and analyzed the wage differential between urban and rural hukou holder in three sectors, including formal sector, self-employment, and “no contract” sector. “No contract” sector is defined as jobs without a written labor contract, and formal sector is defined as wage and salary jobs with a written labor contract. Using this division, they found that the wage differential between urban and rural hukou holders is much larger in the formal sector than in the other two sectors. More specifically, the wage differential is negligible for self-employment and “no contract” workers. Furthermore, even for the very small wage differential, more than 90% of it could be explained by the human capital variables. That is, the hukou-based wage discrimination in self-employment and “no contract” sector is almost non-existent. In contrast, urban hukou holders earn 60% more than rural hukou holders in the formal sector, and nearly 35% of this wage differential cannot be explained by observed characteristics.

As can be seen, although the study above compared the wage discrimination in

different sectors, it did not consider the division between SOEs and private firms. A considerable share of private firms has labor contracts with their employees and thus belongs to the formal sector defined as in Gagnon *et al* (2011). Therefore, we could conclude that no previous study has provided quantitative evidence on labor market discrimination against rural hukou holders in different urban sectors.

3.4 My contributions

To my knowledge, this paper is the first attempt to explore the extent of labor market discrimination against rural hukou in SOEs and private firms, respectively. As is known, the wages in SOEs are mainly set by the government for political reasons, while the wages in private firms are largely determined by the market forces. Therefore, the results of this study can help us better understand whether the hukou-based discrimination is driven by market behaviors or by institutional forces.

Second, this paper contributes to the literature by distinguishing two types of labor market discrimination including wage and hiring discrimination. In addition to analyzing the wage discrimination in SOEs and private firms, this paper will examine whether workers with rural hukou are less likely to be hired in the high wage SOE sector than those with urban hukou. If the hiring differential does exist, I will test how much of the

hiring differential is due to discrimination. To the author's knowledge, this paper is the first one to empirically study the two types of labor market discrimination in China.

Third, this paper makes a methodological contribution to the empirical literature on labor market discrimination in China by adopting a double-selectivity approach to account for selectivity both in sector and hukou status determination. The first selectivity comes from the possibility that stated-owned enterprises selectively hire people with certain characteristics. Another selection problem arises because local governments of Chinese cities can grant urban hukou to some rural hukou holders with certain characteristics who meet the criteria specified by each local government.

Fourth, this paper will provide more convincing empirical evidence on labor market discrimination by various robustness checks. In previous literature, the portion of the wage differential that is not explained by observed characteristics is commonly used as an estimate of the extent of wage discrimination. However, it should be noted that the observationally-equivalent workers may not be truly equivalent, while there may be some unobserved productivity differentials between the two types of workers responsible for the wage gap. These unobserved characteristics are known to the employers, but not known to the econometricians who run the wage regressions. In this case, the literature tends to over-estimate the degree of labor market discrimination. To reduce this bias, I

will include more control variables in the wage regressions. The comprehensive information on personal characteristics provided by available micro dataset (RUMIC-2008) enables us to investigate wage compensation by controlling for individuals' most important characteristics such as school performance, an indicator for job training, occupation and industry. Blau and Kahn (2000) suggested including the industry and occupation as control variables in the wage regressions. Admittedly, if some of the factors controlled for in such regressions such as occupation itself reflect the impact of discrimination, then discrimination will be underestimated. Nonetheless, results of such robustness checks may be instructive in that to include occupation and industry in controls makes for a more conservative estimate (an estimate that is less likely to be an overestimate, although it still could be) (Blau and Kahn, 2000). If workers with different hukou earn differently for very similar jobs, it is more likely that the hukou-based wage discrimination exists.

Another robustness check is that besides using the original Blinder-Oaxaca decomposition (Blinder, 1973; Oaxaca, 1973), I will employ two alternative decomposition techniques developed by Cotton (1988) and by Oaxaca and Ransom (1988; 1994), respectively. The original version of wage decomposition methodology only considered two extreme cases, in which the wage structure for one group represents what the competitive wage structure would be in the absence of discrimination. In the

current empirical literature on the Chinese labor market, almost all of the studies still use the original Blinder-Oaxaca decomposition technique to identify the explained and unexplained wage gaps between two groups of workers.² Cotton (1988) argued that population-weighted coefficients are more accurate than traditional ones as the non-discriminatory wage structure. Another way to decompose the wage differential is to obtain the competitive wage structure from a regression with the pooled sample (Oaxaca and Ransom, 1988; 1994). There is no consensus in the literature about which weighting scheme is unambiguously better than another (Powers et al., 2011). Thus, this paper will report the decomposition results using four alternative non-discriminatory wage structures, namely, urban-weighted, rural-weighted, population-weighted, and pooled sample weighted wage structures.

3.5 Methodology and model specification

3.5.1 Estimating wage discrimination

The most direct way to obtain estimates of the differential effects of hukou status on wages between state-owned enterprises (SOE) and private firms is to include two dummy variables denoting the firm ownership and hukou status as well as an interaction of these

² To the author's knowledge, there is only one exception. Demurger et al. (2012) uses a pooled wage structure in decomposing the wage gaps between different ownerships of firms.

two dummy variables in a Mincer (1974) type wage regression. However, this specification ignores the fact that the wage structures for urban and rural hukou holders in SOEs and private firms may differ from one other. Allowance for different wage structures for two types of workers in two economic sectors requires estimation of four separate wage regressions.

In addition, since workers with each hukou status and in each ownership sector are not randomly drawn from the population, two selection issues need to be considered in order to consistently estimate four wage equations. In summary, we have a system of six equations in total, with two selection equations and four wage equations as follows. Let S_i^* and U_i^* be two latent unobserved continuous variables to determine sector allocation and hukou status, respectively, for person i . W_j^i ($i=U$ or R , $j= S$ or P) denote the wages for urban and rural hukou holders in the SOE sector and private firms, respectively.

$$S_i^* = X_{1i}'d_{1i} + u_{1i}, \text{ SOE sector determination.} \quad (1)$$

$$U_i^* = X_{2i}'d_{2i} + u_{2i}, \text{ Urban hukou determination.} \quad (2)$$

$$\ln W_S^U = X_S^U g_S^U + v_S^U. \quad (3)$$

$$\ln W_S^R = X_S^R g_S^R + v_S^R. \quad (4)$$

$$\ln W_P^U = X_P^U g_P^U + v_P^U. \quad (5)$$

$$\ln W_P^R = X_P^R g_P^R + v_P^R. \quad (6)$$

The error terms in the six equations above are assumed to have the following variance-covariance matrix.

$$\Sigma = \begin{bmatrix} \mathbf{S}_{u1} & \mathbf{r} & a_{11} & a_{12} & a_{13} & a_{14} \\ \mathbf{r} & \mathbf{S}_{u2} & a_{21} & a_{22} & a_{23} & a_{24} \\ a_{11} & a_{21} & \mathbf{S}_S^U & 0 & 0 & 0 \\ a_{12} & a_{22} & 0 & \mathbf{S}_S^R & 0 & 0 \\ a_{13} & a_{23} & 0 & 0 & \mathbf{S}_P^U & 0 \\ a_{14} & a_{24} & 0 & 0 & 0 & \mathbf{S}_P^R \end{bmatrix}. \quad (7)$$

Different specifications on the matrix above lead to different estimation methods. This section provides three alternative ways to estimate the system with three different specifications on the variance-covariance matrix, and then decompose the wage differentials between urban and rural hukou holders in the two ownership sectors, respectively.

3.5.1.1 No selectivity correction

In the absence of selection issues, we can employ OLS estimation to consistently estimate the four wage regressions from equation (3)-(6). This simple specification indeed assumes that all of the off-diagonal terms in (7) are zero. In order to examine the extent of the wage discrimination against rural hukou in each sector, I first adopt the

Blinder-Oaxaca (Oaxaca, 1973; Blinder, 1973) decomposition method to decompose the average log wage differential into the endowment effect which can be explained by productivity-related characteristics, and the unexplained coefficient effect which is commonly used as the estimation for wage discrimination. Specifically, the decomposition of the wage differential between urban and rural hukou holders in a given sector j (SOE or private) can be written as follows.

$$\begin{aligned}
& \overline{\ln W_j^U} - \overline{\ln W_j^R} \\
&= \overline{X_j^U}' \hat{g}_j^U - \overline{X_j^R}' \hat{g}_j^R \\
&= (\overline{X_j^U} - \overline{X_j^R})' g_j^* + [\overline{X_j^U}' (\hat{g}_j^U - g_j^*) + \overline{X_j^R}' (g_j^* - \hat{g}_j^R)]. \quad (8)
\end{aligned}$$

In the equations above, $\overline{\ln W_j^U}$ and $\overline{\ln W_j^R}$ are the predicted mean (log) wages for urban and rural hukou holders in sector j (S or P), \overline{X}' is the mean vector of wage determining variables, \hat{g} is a vector of estimated coefficients (wage structure), and g^* is the non-discriminatory wage structure. The first term above $(\overline{X^U} - \overline{X^R})' g^*$ is attributed to different endowments (productivity-related characteristics) in two groups of workers and is usually called the endowment effect. The second term in the square bracket $[\overline{X^U}' (\hat{g}^U - g^*) + \overline{X^R}' (g^* - \hat{g}^R)]$ is typically interpreted as the part of the wage gap that is associated with differences in returns (coefficients) to the characteristics between the two groups, which often serves as the estimate for discrimination (Liu et al., 2000; Oaxaca, 2007).

A practical concern associated with the adoption of the Blinder-Oaxaca approach is called the index number problem. This refers to the fact that the decomposition of the wage gap is not unique, depending on the choice of the non-discriminatory wage structure, that is, the choice of g^* . The original version of the Blinder-Oaxaca approach assumes that g^* takes extreme values equal to the wage structure of one reference group in the study. For example, if $g^* = \hat{g}^U$, then we assume that the wage structure for urban hukou holders would be adopted in the absence of discrimination (Liu et al., 2000). This is a very common assumption in that the wage structure of the dominant group is usually considered as the hypothetical wage structure in the absence of discrimination. However, if one believes that the current wage structure for rural hukou holders represents what the competitive wage structure would be in the absence of discrimination, then $g^* = \hat{g}^R$. As mentioned earlier, most of studies on the Chinese labor market use this original version of the Blinder-Oaxaca decomposition method (Gagnon et al., 2011; Qu and Zhao, 2011; Gravemeyer et al., 2010; Liu et al., 2000), and employ the two extreme wage structures to approximate the wage structure in the absence of discrimination.

Cotton (1988) argued that derived weights using averages of coefficients for two groups will be more accurate than coefficients for one reference group. According to this approach, the non-discriminatory wage structure in sector j is $g_j^* = f_j^U \hat{g}_j^U + f_j^R \hat{g}_j^R$, where

f_j^U and f_j^R are the proportions of urban and rural hukou holders in sector j , respectively.

Thus, Cotton's weights are sometimes referred as population-weighted non-discriminatory wage structure (Liu et al., 2000).

An alternative way to decompose the wage differential is to obtain the competitive wage structure (g^*) from a regression with the pooled sample (Oaxaca and Ransom, 1988; 1994). As they argued, if by the absence of discrimination one means the complete cessation of existing discrimination activity, then it might be reasonable to suppose that the resulting competitive wage structure would be a blend of the currently observed wage structures for the two groups of workers. A natural weighting scheme for approximating the competitive wage structure can be derived from the parameter vector estimated with the pooled sample of two groups of workers.

However, there is no consensus in international literature about which weighting scheme is unambiguously better than another (Powers et al., 2011). Thus, this paper will report the decomposition results using four alternative non-discriminatory wage structures, respectively, including the wage structure of urban hukou holders, rural hukou holders, population-weighted wage structure, and the wage structure from the pooled sample.

In summary, I will run four wage regressions for urban and rural hukou holders in two ownership sectors respectively. Then, for each sector j (SOE or private), the wage decomposition will be conducted using equation (8) by four alternative non-discriminatory wage structures (g_j^*) specified above. Using this method, I can examine the degree of labor market discrimination against rural hukou holders in state-owned and private enterprises.

3.5.1.2 Independent selection process

This section takes into account the two selection issues but assumes that the two selection processes are independent ($r=0$). That is, we assume the matrix of the error terms in (7) takes the following form.

$$\Sigma' = \begin{bmatrix} s_{u1} & 0 & a_{11} & a_{12} & a_{13} & a_{14} \\ 0 & s_{u2} & a_{21} & a_{22} & a_{23} & a_{24} \\ a_{11} & a_{21} & s_S^U & 0 & 0 & 0 \\ a_{12} & a_{22} & 0 & s_S^R & 0 & 0 \\ a_{13} & a_{23} & 0 & 0 & s_P^U & 0 \\ a_{14} & a_{24} & 0 & 0 & 0 & s_P^R \end{bmatrix}. \quad (9)$$

Behrman *et al.* (1981) show that if the two selection rules are independent (i.e. the unobservable variables in the selection rule for the SOE sector are not correlated with the unobserved variables in the selection rule for hukou status, i.e., $r=0$), then the standard

Heckman two-step approach can be applied (Heckman, 1979). As a result, they show that the selectivity bias can be corrected by adding two regressors to the wage function, whereby each regressor indicates the probability that an individual will be employed in the SOE sector and has an urban hukou.

Let “S” be a dummy variable equal to 1 if $S_i^* \geq 0$ and 0 otherwise. Similarly, we define “U” as a dummy variable equal to 1 if $U_i^* \geq 0$ and 0 if $U_i^* < 0$. S and U indicate whether an individual is working in a state-owned enterprise (SOE) and has an urban hukou, respectively.

In the first step, two univariate probit models are estimated for both sector and hukou status determination as in the single selection case, from which the inverse Mills ratios are calculated (Henneberger and Sousa-Poza, 1998). In the second step, these ratios are used as regressors in the wage function. More specifically, by estimating the probit model $\text{prob}(S=1) = \Phi(X_1 d_1)$, we can obtain the inverse Mills ratios for selection into the SOE

and private sector, respectively: $\hat{I}_s = \frac{f(X_1 d_1)}{\Phi(X_1 d_1)}$ for state-owned enterprises ($S=1$), and

$\hat{I}_p = \frac{-f(X_1 d_1)}{1 - \Phi(X_1 d_1)}$ for private firms ($S=0$). f is the standard normal density

function and Φ is the corresponding standard normal cumulative distribution function.

The correction terms for selection into urban and rural hukou status are derived

analogously by estimating the univariate probit model: $\text{prob}(U=1) = \Phi(X_2 d_2)$. As a result, we obtain $\hat{I}_U = \frac{f(X_2 d_2)}{\Phi(X_2 d_2)}$ for urban hukou holders ($U=1$) and $\hat{I}_R = \frac{-f(X_2 d_2)}{1 - \Phi(X_2 d_2)}$ for rural hukou holders ($U=0$).

By estimating the two univariate probit models for sector and hukou status determination, selectivity correction terms are constructed as above and used to augment the wage equations for two types of workers in the two economic sectors. The four augmented wage equations to be estimated are specified as follows.

$$\ln W_S^U = X_S^U g_S^U + a_{11} \hat{I}_S + a_{12} \hat{I}_U + w_S^U, \quad (10)$$

$$\ln W_S^R = X_S^R g_S^R + a_{21} \hat{I}_S + a_{22} \hat{I}_R + w_S^R, \quad (11)$$

$$\ln W_P^U = X_P^U g_P^U + a_{31} \hat{I}_P + a_{32} \hat{I}_U + w_P^U, \quad (12)$$

$$\ln W_P^R = X_P^R g_P^R + a_{41} \hat{I}_P + a_{42} \hat{I}_R + w_P^R. \quad (13)$$

Again, the left-hand side variables denote the wages for urban and rural hukou holders in the SOE sector and private firms, respectively. The superscript denotes the hukou status (urban versus rural hukou) and subscript denotes the economic sector. w_j^i ($i=U$ or R , $j= S$ or P) are random disturbance terms with mean zero, a is a vector of coefficients.

In order to identify the wage equations above, each selection equation should include at least one exogenous variable assumed to be relevant only for this equation which is excluded from the other selection and the wage equations (Rabe, 2011). Fortunately, the comprehensive information on personal characteristics provided by available micro dataset (RUMIC-2008) contains some variables that can be used to identify these equations. The excluded instrument that identifies SOE sector determination equation is a dummy variable indicating whether the individual is recommended by the government for this job. For the SOE selection equation, since the SOE sector has very close relationship with the government in China, the government sometimes introduces some people to the state-owned enterprises, but this kind of government reference is very rare in private firms. Thus, whether or not to have government reference for a job is a good indicator for the sector determination. Moreover, since state-owned enterprises usually have established wage schemes for workers with different characteristics such as education and experience, it is unlikely that the government reference would directly affect workers' wages in the SOE sector.

In addition, the variable included in the hukou determination equation but excluded from the wage equation is a continuous variable representing the total amount of money the individual received from his or her parents in the last twelve months. As introduced previously, the criteria to grant urban hukou differs from one place to another. However,

many cities grant urban hukou to people who make an investment in the city, or purchase some property such as a house, etc. Therefore, if people receive more money from their parents in the past year, they are more likely to meet the criteria specified by local government to be granted an urban hukou. This variable is excluded from the wage equation because employers can seldom know that how much money a worker received from his or her parents in the past year, and thus cannot pay workers differently based on this unknown information.

Given the estimates from augmented wage regressions (10)-(13), I can decompose the average wage differentials between urban and rural hukou holders in state-owned enterprises and private firms, respectively. However, the decomposition becomes more complicated when there are selectivity correction terms. The complexity arises from the way to treat the selection term when we decompose the average (log) wage differential. Previous literature has provided two major ways to deal with the selectivity term in decomposition. Dolton and Makepeace (1986) treat the selectivity-correction terms in the same way as the other regressors in the wage functions, while Reimers (1983) proposes that the selectivity-correction terms can be used to modify the wage differentials, and then the modified wage differential is decomposed to endowment effect and coefficient effect. As Beller and Blau (1988) argued, the adjustment for selectivity bias is important, particularly when one is interested in potential differences in employer treatment of two

groups. In this case, the focus should be on wage offers rather than observed wages (Beller and Blau, 1988; Reimers, 1983). Therefore, I adopt Reimers's strategy to modify the wage differential, and then decompose the adjusted wage differential into the endowment effect and coefficient effect.

Given the estimates of wage regressions above, I decompose the adjusted wage differential in the two ownership sectors. By equation (10) and (11), the wage decomposition in the SOE sector is as follows (for example: $g^* = \hat{g}^U$):

$$(\overline{\ln W_S^U} - a_{11}\bar{I}_S - a_{12}\bar{I}_U) - (\overline{\ln W_S^R} - a_{21}\bar{I}_S - a_{22}\bar{I}_R) = (\overline{X_S^U} - \overline{X_S^R})' \hat{g}_S^U + \overline{X_S^R}' (\hat{g}_S^U - \hat{g}_S^R), \quad (14)$$

The first term on the right hand side $(\overline{X_S^U} - \overline{X_S^R})' \hat{g}_S^U$ reflects the proportion of adjusted wage differential that can be explained by characteristics, and the last term $\overline{X_S^R}' (\hat{g}_S^U - \hat{g}_S^R)$ serves as an estimate of wage discrimination in the SOE sector. Similarly, by equation (12) and (13), the wage decomposition in the private sector is:

$$(\overline{\ln W_P^U} - a_{31}\bar{I}_P - a_{32}\bar{I}_U) - (\overline{\ln W_P^R} - a_{41}\bar{I}_P - a_{42}\bar{I}_R) = (\overline{X_P^U} - \overline{X_P^R})' \hat{g}_P^U + \overline{X_P^R}' (\hat{g}_P^U - \hat{g}_P^R). \quad (15)$$

Again, the wage decomposition above with selectivity-correction terms will be done with four alternative weighting wage structure in the absence of discrimination,

respectively, and all of the results will be reported in the next section.

3.5.1.3 Double selectivity approach

In the case of $r \neq 0$, we adopt the double-selectivity approach to estimate the system of equations (1)-(6) with the stochastic specification in (7). Tunali (1986) shows that if the error terms have a joint normal distribution, then a two-step estimation procedure can be applied to correct for the double-selectivity issue, which is very similar to Heckman's two step method. Specifically, the two selection equations are estimated using a bivariate probit model, and augmented selectivity correction terms are derived as additional regressors in four wage equations.

In our context, there are four groups of workers defined by two dummy variables including "S" denoting the sector of employment and "U" denoting the hukou status, respectively. After estimating the bivariate probit model for the two selection equations, we can obtain the following selectivity terms. Set $C_1 = X_{1i}'d_{1i}$, $C_2 = X_{2i}'d_{2i}$, $M_1 = \frac{C_1 - rC_2}{\sqrt{1 - r^2}}$, and $M_2 = \frac{C_2 - rC_1}{\sqrt{1 - r^2}}$. Φ_2 is the bivariate standard normal distribution function, f is the univariate standard normal density function, and Φ is the cumulative standard normal distribution. The selectivity terms generated by the bivariate estimation are $\hat{I}_S^U = \frac{f(C_1)\Phi(M_2)}{\Phi_2(C_1, C_2; r)}$; $\hat{I}_U^S = \frac{f(C_2)\Phi(M_1)}{\Phi_2(C_1, C_2; r)}$; $\hat{I}_S^R = \frac{f(C_1)\Phi(-M_2)}{\Phi_2(C_1, -C_2; -r)}$;

$$\hat{I}_R^S = -\frac{f(C_2)\Phi(M_1)}{\Phi_2(C_1, -C_2; -r)} ; \quad \hat{I}_P^U = -\frac{f(C_1)\Phi(-M_2)}{\Phi_2(-C_1, C_2; -r)} ; \quad \hat{I}_U^P = -\frac{f(C_2)\Phi(-M_1)}{\Phi_2(-C_1, C_2; -r)} ;$$

$$\hat{I}_P^R = -\frac{f(C_1)\Phi(-M_2)}{\Phi_2(-C_1, -C_2; r)} ; \quad \hat{I}_R^P = -\frac{f(C_2)\Phi(-M_1)}{\Phi_2(-C_1, -C_2; r)} .$$

In the second step, I estimate four augmented wage equations for urban and rural hukou holders in two ownership sectors as specified below.

$$\ln W_S^U = X_S^U \mathbf{g}_S^U + a_{11} \hat{I}_S^U + a_{12} \hat{I}_U^S + w_S^U , \quad (16)$$

$$\ln W_S^R = X_S^R \mathbf{g}_S^R + a_{21} \hat{I}_S^R + a_{22} \hat{I}_R^S + w_S^R , \quad (17)$$

$$\ln W_P^U = X_P^U \mathbf{g}_P^U + a_{31} \hat{I}_P^U + a_{32} \hat{I}_U^P + w_P^U , \quad (18)$$

$$\ln W_P^R = X_P^R \mathbf{g}_P^R + a_{41} \hat{I}_P^R + a_{42} \hat{I}_R^P + w_P^R . \quad (19)$$

Similar to the previous case, I adopt Reimers's strategy to modify the wage differential with the selectivity terms, and then decompose the adjusted wage differential into the endowment effect and coefficient effect. Equation (20) and (21) provide the formulae for the wage decomposition in the SOE sector and private sector, respectively ($\mathbf{g}^* = \hat{\mathbf{g}}^U$).

$$\overline{(\ln W_S^U - a_{11} \bar{I}_S - a_{12} \bar{I}_U)} - \overline{(\ln W_S^R - a_{21} \bar{I}_S - a_{22} \bar{I}_R)} = (\bar{X}_S^U - \bar{X}_S^R)' \hat{\mathbf{g}}_S^U + \bar{X}_S^R' (\hat{\mathbf{g}}_S^U - \hat{\mathbf{g}}_S^R) , \quad (20)$$

$$\overline{(\ln W_P^U - a_{31} \bar{I}_P - a_{32} \bar{I}_U)} - \overline{(\ln W_P^R - a_{41} \bar{I}_P - a_{42} \bar{I}_R)} = (\bar{X}_P^U - \bar{X}_P^R)' \hat{\mathbf{g}}_P^U + \bar{X}_P^R' (\hat{\mathbf{g}}_P^U - \hat{\mathbf{g}}_P^R) . \quad (21)$$

In summary, the wage decomposition in a double-selectivity framework works as follows. I first estimate a bivariate probit model for sector determination and hukou status determination, and obtain eight selectivity terms as above (the lambdas). In the second step, I estimate four augmented wage equations (equation 16-19) and decompose the adjusted wage differential into a proportion due to characteristics and an estimate of wage discrimination in each sector (by equation 20 and 21).

3.5.2 Estimating hiring discrimination

3.5.2.1 No selectivity correction

It is documented in the previous literature that on average, workers with rural hukou are less likely hired by the state-owned enterprises than those with urban hukou (Gagnon et al., 2011). However, it is not known in the literature about how much of the average hiring differential is due to hiring discrimination against rural hukou in the SOE sector. To fill in this gap, this section adopts the similar decomposition technique to decompose the overall hiring differential into the endowment effect and the proportion due to hiring discrimination.

Specifically, if the hiring probability in the SOE sector is modeled with a linear

probability model, then the Blinder-Oaxaca decomposition technique can be directly applied here.³ For hukou status i (urban or rural), I estimate a linear probability model as follows.

$$\Pr(S^i = 1) = X_1^i d_1^i + u_1^i, i=U \text{ or } R. \quad (22)$$

In the equation above, $\Pr(S^i = 1)$ is the probability that a worker with hukou i (urban or rural) is hired in the SOE sector, X_1^i is a vector of individual and job-related characteristics, and d_1^i is a vector of coefficients on these characteristics, and u_1^i is the random error term. According to the Blinder-Oaxaca decomposition method, the linear probability model is estimated for urban and rural hukou holders, respectively, and the average hiring differential is decomposed as follows.

$$\begin{aligned} & \overline{\Pr(S^U = 1)} - \overline{\Pr(S^R = 1)} \\ &= \overline{X_1^U}' \hat{d}_1^U - \overline{X_1^R}' \hat{d}_1^R \\ &= (\overline{X_1^U} - \overline{X_1^R})' \hat{d}_1^* + [\overline{X_1^U}' (\hat{d}_1^U - \hat{d}_1^*) + \overline{X_1^R}' (\hat{d}_1^* - \hat{d}_1^R)]. \end{aligned} \quad (23)$$

In the equations above, $\overline{\Pr(S^U = 1)}$ and $\overline{\Pr(S^R = 1)}$ are the predicted mean probabilities for urban and rural hukou holders to work in the SOE sector, $\overline{X_1^U}$ and

³ I also tried probit models and did the probit decomposition of the overall hiring differential using non-linear decomposition technique developed by Yun (2004; 2005) and Bauer and Sinning (2008). The command in STATA is nldecompose. The results are very similar to those obtained from the linear probability model. Non-linear decomposition results are available upon request.

$\overline{X_1^R}$ are the mean vectors of hiring determining variables in the SOE sector for urban and rural hukou holders respectively, \hat{d}_1^U and \hat{d}_1^R are the vectors of estimated coefficients, and \hat{d}_1^* is the non-discriminatory coefficient structure. Again, the first term above $(\overline{X_1^U} - \overline{X_1^R})' \hat{d}_1^*$ is attributed to different endowments (productivity-related characteristics) in two groups of workers and is usually called the endowment effect. The second term in the square bracket $[\overline{X_1^U}'(\hat{d}_1^U - \hat{d}_1^*) + \overline{X_1^R}'(\hat{d}_1^* - \hat{d}_1^R)]$ is associated with differences in returns (coefficients) to the characteristics between the two groups, which is the estimate for hiring discrimination.

3.5.2.2 Hukou selectivity correction

When we model hiring determination for urban and rural hukou holders, there is a single selection issue left which is the selection of hukou status. I will adopt the standard Heckman two-step procedure to deal with this single selection issue in estimating hiring discrimination.

Specifically, we can obtain the hukou selectivity correction terms by estimating the probit model with hukou status as the dependent variable. If sector determination is modeled with a linear probability model, then I estimate the two equations for urban and rural hukou holders with selectivity correction terms as follows:

$$\Pr(S^U = 1) = X_1^U d_1^U + q_U \hat{I}_U + u_1^U, \quad (24)$$

$$\Pr(S^R = 1) = X_1^R d_1^R + q_R \hat{I}_R + u_1^R. \quad (25)$$

After obtaining the estimates from this linear probability model, the adjusted hiring differential will be decomposed into the usual endowment effect and coefficient effect, as in equation (26) (Again, take the example of $\hat{d}_1^* = \hat{d}_1^U$).⁴

$$(\overline{\Pr(S^U = 1)} - q_U \bar{I}_U) - (\overline{\Pr(S^R = 1)} - q_R \bar{I}_R) = (\bar{X}_1^U - \bar{X}_1^R)' \hat{d}_1^U + \bar{X}_1^R' (\hat{d}_1^U - \hat{d}_1^R). \quad (26)$$

In summary, this section has explained different models to analyze wage and hiring discrimination against rural hukou holders in state-owned enterprises and private firms, including those with and without selectivity correction. All of the results will be reported in the next section.

3.6 Data description and econometric results

I will utilize 2008 wave of the Rural-Urban Migration in China (RUMiC) survey to analyze the proposed question. The Longitudinal Survey on Rural Urban Migration in

⁴ In the presence of selectivity terms, it would be very difficult to apply non-linear decomposition technique. The difficulty arises from the fact that the selectivity terms cannot be separated from other regressors to adjust the overall differential. Yun (1999) proposed to use Taylor expansion to linearize the probit equation and then do the decomposition as in the linear case. However, this method involves approximation, and very few previous studies have used it. Currently, the non-linear decomposition commands in STATA including fairlie and nldecompose neither allow for adjustment for selection.

China (RUMiC) consists of three parts: the Urban Household Survey, the Rural Household Survey and the Migrant Household Survey. It was initiated by a group of researchers at the Australian National University, the University of Queensland and the Beijing Normal University and was supported by the Institute for the Study of Labor (IZA), which provides the Scientific Use Files. The financial support for RUMiC was obtained from the Australian Research Council, the Australian Agency for International Development (AusAID), the Ford Foundation, IZA and the Chinese Foundation of Social Sciences.

The survey covers three groups of Chinese households: 5000 migrant households who worked in 15 designated cities (migrant survey) in nine provinces or metropolitan areas; 5000 urban local incumbent households in the same cities (urban household survey), and 8000 rural households (rural household survey). Most of the migrants have rural hukou while the urban sample largely takes urban hukou. This feature gives us enough observations for both urban and rural hukou holders. For the research purpose of this paper, I will only use the urban sample and migrant sample in 2008 wave of the survey. The nine provinces or metropolitan areas covered in the survey are Shanghai, Guangdong, Jiangsu, Zhejiang, Anhui, Hubei, Sichuan, Chongqing and Henan. The first four of these are the largest migrant destinations, and the remaining five are the largest migration sending areas. The RUMiC survey of migrant workers in urban cities, to the

best of our knowledge, is the only random sample of migrant workers for China so far.

The survey records detailed individual information, such as monthly earnings, hours of work, demographic characteristics, and work and employment information. A detailed definition of each variable used in this study is provided in the data appendix.

For the purpose of this study, I restrict the sample to employees aged from 18 to 60 in urban areas. Furthermore, people working at foreign-owned companies and self-employed people are excluded from our sample. The remaining sample consists of 5,012 urban hukou holders and 3,795 rural hukou holders. The total sample size is 8807. The summary statistics of the key variables in the data set are presented in Table 3.1.

Table 3.1 Mean Values of Key Variables

	SOE		Private	
	<u>Urban hukou</u>	<u>Rural hukou</u>	<u>Urban hukou</u>	<u>Rural hukou</u>
Age	40.18	32.08	38.01	30.73
Years of schooling	12.53	9.65	11.88	9.36
Experience	21.67	16.25	20.12	15.12
Monthly earnings	2294.63	1529.76	2018.49	1500.99
Hourly wage	15.08	7.40	12.76	6.72
Male	0.58	0.65	0.55	0.61
Parent money	683.23	361.57	668.40	214.02
Gov. reference	0.45	0.03	0.16	0.003
Firm size	1261.06	61.62	254.48	15.03
Social capital	35.58	28.72	33.19	31.93
N	3,198	658	1,814	3,137

Note: A detailed definition of each variable is provided in the data appendix.

As can be seen from the table, among 5,012 urban hukou holders, more than half of them (3,198) are working in state-owned enterprises, whereas only a very small proportion of rural hukou holders are working in this high wage sector. In addition, the average monthly earnings are 2294.6 (yuan) and 1529.8 in the SOE sector for urban and rural hukou holders, respectively, so the average earning differential is about 50%. On the other hand, the average differential in terms of monthly earnings is about 30% in the private firms.⁵ Given this evidence so far, we cannot conclude that the wage discrimination is more severe in SOEs than private firms because the wage differentials could be driven by differences in productivity-related characteristics. That is, the raw wage differential presented here is only the average one but does not control for workers' characteristics.

Table 3.1 shows that on average, urban hukou holders are older than rural hukou holders indicating that most of rural migrants in cities are young people aged around 30. Furthermore, more than 60% of rural hukou holders are males, while the gender composition is more balanced for urban hukou holders. In terms of human capital variables, urban hukou holders have more education than rural hukou holders, and the

⁵ In the data set, some firms' ownership are identified as collective-owned. This is a special firm ownership in China due to the planned economy in which some firms were owned by a community, a city, etc. Since the transformation from planned economy to market economy in 1978, most of the collective-owned firms have become more market-oriented and privatized especially after 1990s (Sun, 2008). Therefore, although some of the original collective-owned firms are still officially called collective, they are very similar to private enterprises in practice. So I put the collective-owned firms in the dataset to the category of private enterprises.

average education is slightly higher in state-owned enterprises than in the private sector. The data set also contains a variable to reflect people's social capital measured by the number of greetings sent in the past Chinese new year festival. As seen in Table 3.1, urban hukou holders in the SOE sector have the highest social capital, and urban hukou holders have more social capital than rural hukou holders in each sector. For a job-related characteristic, workers with urban hukou tend to work in larger firms than those with rural hukou. In addition, the SOE firms are typically larger than private firms.

The excluded variable to identify the sector selection equation is a dummy variable indicating whether the individual is recommended by the government for this job. Table 3.1 indicates that nearly half of the urban hukou holders in the SOE sector are recommended by the government for this job, while this ratio is much smaller in private sector. This is because the SOE sector has very close relationship with the government in China, and the government sometimes introduces some people to the state-owned enterprises, but this kind of government reference is very rare in the private firms. Moreover, the excluded variable to identify the hukou determination equation is the total amount of money the individual received from his or her parents in the last twelve months. As is seen, urban hukou holders received more money from their parents than rural hukou holders in either sector, which can partly verify our identification variable.

As Giulietti et al. (2012) claimed, in the RUMiC dataset, hourly wages are more prone to measurement error (being calculated by combining monthly wages and weekly hours worked), so I choose to use monthly wages as the major dependent variable. As a robustness check, the wage equations have also been estimated using hourly wages, and the results are presented in the appendix.

3.6.1 Evidence on wage discrimination and ownership structure

3.6.1.1 No selectivity correction

In the first step, the wage equation is estimated for urban and rural hukou holders separately within each sector without dealing with the selectivity issue and the results are reported in Table 3.2. For the purpose of estimating the extent of discrimination more accurately, I control for individuals' productivity-related characteristics as well as job-related information as many as the data set allows. The dependent variables in all of wage equations are the natural logarithm of monthly earnings measured in nominal Chinese currency (yuan) in 2007. The independent variables include potential labor market experience and its square, completed years of schooling, social capital, seniority, number of children, health status, weight, height, school performance, gender, marriage status, a dummy variable indicating job training, firm size, and a set of dummies including occupation, industry, and province dummies to control for the difference in cost

of living in different regions.

Table 3.2 Log Wage Regressions without Selectivity Correction

	SOE		Private	
	Urban hukou	Rural hukou	Urban hukou	Rural hukou
Years of schooling	0.025*** (0.005)	0.022*** (0.008)	0.028*** (0.007)	0.036*** (0.004)
Experience	-0.003 (0.005)	0.018*** (0.006)	0.009 (0.006)	0.021*** (0.003)
Exp. Sq	-0.0001 (0.0001)	-0.0005*** (0.0001)	-0.0005*** (0.0001)	-0.0005*** (0.0001)
Male	0.247*** (0.038)	0.091* (0.047)	0.343*** (0.052)	0.092*** (0.023)
Social capital	0.0016*** (0.0003)	0.0002 (0.0003)	0.001*** (0.0004)	-0.0001 (0.0002)
Firm tenure	0.013*** (0.001)	0.015*** (0.004)	0.009*** (0.002)	0.019*** (0.002)
Constant	8.425*** (0.532)	5.582*** (0.581)	6.748** (0.716)	5.704*** (0.271)
N	2,679	639	1,455	3,040
Adjusted R-sq	0.2155	0.2536	0.2241	0.1725

Note: *** significant at 1%; ** significant at 5%; * significant at 10%. Figures in parentheses are standard errors. The dependent variables in all of wage equations are the natural logarithm of monthly earnings in 2007. All regressions also control for number of children, health status, weight, height, school performance, gender, marriage status, a dummy variable indicating job training, firm size, and a set of dummies including occupation, industry, and province dummies.

Table 3.2 presents the coefficients of the major human capital variables, and the coefficients of other variables are not reported. As the table shows, the return to schooling is around 3 percent in China and is very similar between urban and rural hukou holders in each sector, which is consistent with recent studies (Song, 2012; Demurger et al., 2012).

In addition, it turns out that the coefficients on human capital variables are all statistically

significant for rural hukou holders and mostly larger than the coefficients for urban hukou holders in both sectors, whereas the coefficients on social capital display the opposite pattern. This may imply that the wage structure is more market-oriented for rural hukou holders, while social networking is very important for the wages of urban hukou workers. Comparing the state-owned enterprises (SOE) and private firms, we can find that the wage structure is very similar for rural hukou holders in these two sectors. For urban hukou holders, the return to major human capital variables is higher in private firms than in SOEs, including years of schooling and work experience. However, it is noteworthy that the return to social capital and firm tenure is higher in SOEs than private firms for urban hukou holders.

Another finding from Table 3.2 is that for urban hukou holders, males with the same observed characteristics earn about 30% more than females, which suggests an evidence of gender discrimination. For rural hukou holders, the gender wage premium is about 10%. We can conclude that the gender discrimination is more severe among urban hukou holders than among those with rural hukou.

Table 3.3 reports the decomposition of the overall wage differential into the explained and unexplained components in terms of log differentials using equation (8). The four alternative non-discriminatory wage structures are used as weights for the wage

decomposition, including wage structures for urban and rural hukou holders, respectively, population-weighted and pooled-sample wage structures. The raw log wage differential is higher in SOE sector than in private sector between urban and rural hukou holders. Furthermore, the entire wage differential in the private sector between urban and rural hukou holders is due to people's productivity-related characteristics, meaning that there is no any discrimination in the private sector. In contrast, there is some proportion of wage differential in the SOE sector that can not be explained by observed characteristics, although it is very small. In summary, if we don't take into account the double selection issues, we find that the wage discrimination is non-existent in the private sector, and very small in magnitude in the SOE sector.

Table 3.3 Wage Decomposition without Selectivity Correction

		Urban-weighted	Rural-weighted	Pooled sample weighted	Population-weighted
SOE	Total diff	0.294	0.294	0.294	0.294
		(0.022)	(0.022)	(0.022)	(0.022)
	Explained	0.287	0.289	0.292	0.287
		(0.063)	(0.101)	(0.021)	(0.055)
	Unexplained	0.008	0.005	0.003	0.007
		(0.065)	(0.103)	(0.013)	(0.058)
Private	Total diff	0.162	0.162	0.162	0.162
		(0.020)	(0.020)	(0.020)	(0.020)
	Explained	0.289	0.226	0.170	0.250
		(0.031)	(0.090)	(0.016)	(0.058)
	Unexplained	-0.126	-0.064	-0.008	-0.087
		(0.035)	(0.092)	(0.009)	(0.060)

Note: The main entries represent the decomposition of log wage differential, in which wage is measured by monthly earnings. Figures in parentheses are standard errors.

The next section will take into account the double-selectivity issue and provide more convincing results about the extent of wage discrimination in firms with different ownerships.

3.6.1.2 Double-selectivity correction

Table 3.4 presents the results of two selection equations using two single probit models and a bivariate probit model, respectively. The former model assumes that the hukou selection rule and sectoral choice are independent ($\rho=0$), while the model presented in the last column assumes that the two selection rules are correlated with each other ($\rho\neq 0$). For the sector determination equation, the estimated coefficients are standard ones in that people who have more education and work experience are more likely to work in the SOE sector. In addition, the coefficients on the excluded variable (Gov. reference) are both positively significant in two specifications, partly verifying my hypothesis that people with government reference are more likely to be hired in SOEs because the SOE sector has very close relationship with the government in China. For the hukou determination equation, we can see that the excluded variable (log of parent money) also has expected effect on the probability of obtaining an urban hukou. People who receive more money from their parents tend to be wealthier and thus more likely to convert their hukou from rural to urban.

Table 3.4 Probit Estimates for Selection Equations

	<u>Univariate Probit</u>	<u>Bivariate Probit</u>
<i>Equation 1 Sector determination</i>		
Years of schooling	0.074 *** (0.007)	0.088 *** (0.009)
Experience	0.038 *** (0.006)	0.048 *** (0.008)
Exp. Sq	-0.001 *** (0.0001)	-0.001 *** (0.0002)
Male	-0.112 ** (0.050)	-0.113 * (0.063)
Firm tenure	0.023 *** (0.002)	0.023 *** (0.003)
Gov. reference	0.712 *** (0.049)	0.727 *** (0.063)
Constant	-2.875 *** (0.591)	-2.947 *** (0.743)
N	7828	5359
P-value	0.000	0.000
<i>Equation 2 Hukou determination</i>		
Years of schooling	0.243 *** (0.018)	0.241 *** (0.018)
Experience	0.140 *** (0.015)	0.140 *** (0.015)
Exp. Sq	-0.002 *** (0.0003)	-0.002 *** (0.0003)
Male	-0.431 *** (0.115)	-0.436 *** (0.114)
Firm tenure	0.045 *** (0.006)	0.044 *** (0.006)
ln(parentmoney)	0.067 *** (0.012)	0.066 *** (0.012)
Constant	-7.434 *** (1.389)	-7.408 *** (1.384)
N	5359	5359
P-value	0.000	0.000
ρ	0.000	0.177 *** (0.050)

Note: *** significant at 1%; ** significant at 5%; * significant at 10%. Figures in parentheses are standard errors. All regressions also control for variables that are included in the wage regressions.

The main purpose of this study is not to explain why certain individuals work in the SOE sector or have an urban hukou, but instead to investigate the possible selectivity bias which may result from non-random selection. Therefore, the estimated coefficients for the two equations above will not be elaborated on here. As the table shows, ρ is significantly positive implying that the inclination to obtain urban hukou and the inclination to work in the SOE sector are positively related to each other.

After estimating the selection equations, I run four augmented wage equations with Heckman selectivity terms for the case of $\rho=0$, and another four augmented wage equations with Tunali double-selectivity terms for the case of $\rho \neq 0$, respectively. The results of wage regressions are provided in the appendix, Table A1 and A2, respectively. As can be seen from Table A1, the two selection issues are indeed very important. For example, the coefficient on I_s is 0.559 and statistically significant, implying that rural hukou holders are positively selected into the SOE sector. That is, the average wage of rural hukou holders working in the SOE sector is greater than what a random person from the population would earn in the SOE sector. In addition, the coefficients on the urban hukou selectivity terms are negative in each sector, implying that there is a negative correlation between the inclination to obtain an urban hukou and the wage rate.

Given the regression results with double-selectivity correction, I decompose the selectivity-adjusted wage differential to the proportion due to characteristics and the remaining part due to discrimination as described in the previous section. Accordingly, I obtain the wage decomposition results with double-selectivity correction in Table 3.5 for cases of $\rho=0$ and $\rho\neq 0$, respectively.

Table 3.5 Wage Decomposition with Double Selectivity Correction

		Urban- weighted	Rural- weighted	Pooled sample weighted	Population- weighted
<i>Panel A Double selectivity ($\rho=0$)</i>					
SOE	Total diff (adjusted)	1.193 (0.415)	1.193 (0.415)	1.193 (0.415)	1.193 (0.415)
	Explained	-0.061 (0.201)	0.717 (0.306)	0.952 (0.333)	0.071 (0.175)
	Unexplained	1.254 (0.465)	0.476 (0.213)	0.241 (0.087)	1.122 (0.410)
Private	Total diff (adjusted)	0.603 (0.148)	0.603 (0.148)	0.603 (0.148)	0.603 (0.148)
	Explained	0.339 (0.259)	0.326 (0.118)	0.512 (0.095)	0.331 (0.121)
	Unexplained	0.264 (0.294)	0.277 (0.244)	0.092 (0.062)	0.272 (0.226)
<i>Panel B Double selectivity ($\rho\neq 0$)</i>					
SOE	Total diff (adjusted)	1.096 (0.393)	1.096 (0.393)	1.096 (0.393)	1.096 (0.393)
	Explained	0.712 (0.311)	-0.071 (0.205)	0.877 (0.316)	0.579 (0.260)
	Unexplained	0.384 (0.200)	1.167 (0.449)	0.218 (0.082)	0.517 (0.219)

Private	Total diff (adjusted)	0.322	0.322	0.322	0.322
		(0.112)	(0.112)	(0.112)	(0.112)
	Explained	0.273	-0.038	0.263	0.077
		(0.118)	(0.252)	(0.057)	(0.165)
	Unexplained	0.049	0.361	0.060	0.246
		(0.222)	(0.301)	(0.059)	(0.239)

Note: The top panel ($\rho=0$) assumes that the hukou selection rule and sector choice are independent with each other, while the bottom panel ($\rho\neq 0$) assumes that the two selection rules are correlated.

The decomposition results show that the wage discrimination is unambiguously more severe in the SOE sector than in private firms, regardless of the weight used for non-discriminatory wage structure. For example, if we focus on the results for pooled-sample weighted decomposition, the unexplained log wage differential is 0.241 in state-owned enterprises, but only 0.092 in private firms in the case of $\rho=0$. Similarly, for the case of $\rho\neq 0$, the unexplained log wage differential is 0.218 in SOEs and 0.06 in private firms. If we translate the log differential into percentage points, the results from Tunali double-selectivity approach ($\rho\neq 0$) suggest that for observationally-equivalent workers, urban hukou holders earn about 30% more than rural hukou holders do in the SOE sector, but only 5% more in the private sector. If we take urban hukou holders' wage structure as the non-discriminatory wage structure (which is the most frequently used weight in previous literature), then column 1 in Table 3.5 informs us that comparable workers with urban hukou earn 50% more than rural hukou holders in state-owned enterprises and again 5% more in private firms ($\rho\neq 0$).

Compared with the results in Table 3.3, the magnitude of wage discrimination is increased by the selectivity adjustment, especially in the SOE sector. This is because rural hukou holders are positively selected into the SOE sector, while there is a negative correlation between the inclination to obtain an urban hukou and the wage rate in the SOE sector. In other words, mean wage offers are above mean observed wages among urban hukou holders and below mean observed wages among rural hukou holders. Therefore, the OLS results without adjusting for selectivity under-estimate the extent of wage discrimination in the SOE sector.

3.6.1.3 Robustness check for wage discrimination

In addition to conducting robustness checks by using different non-discriminatory wage structures, this section will provide another robustness check by using hourly wage as the dependent variable. The results are presented in Table A3 and A4 in the appendix. As can be seen, we still observe the general picture that SOEs are more discriminatory than private firms in terms of wages. The unexplained wage differentials between urban and rural hukou holders are mostly larger in SOEs than in private firms. In some cases, the unexplained part is similar between the two sectors, but there is no case in which the discrimination is significantly larger in private firms than in the SOE sector. In summary, the difference in terms of the extent of wage discrimination between the SOE and private sectors is smaller if we use hourly wage compared to monthly earnings. Since hourly

wages are more prone to measurement error in the RUMiC dataset (Giulietti et al., 2012)

I choose to use monthly earnings as the major measure for our discussion purposes.

3.6.2 Evidence on hiring discrimination and ownership structure

In addition to analyzing the hukou-based wage discrimination in firms with different ownerships, this section examines another type of labor market discrimination, namely hiring discrimination in the high-pay SOE sector. As Table 3.1 shows, among 5,012 urban hukou holders, about 64% of them (3,198) are working in the state-owned enterprises, whereas only 17% of rural hukou holders are working in this high wage sector. The raw hiring differential in the SOE sector between two types of workers is about 47 percent. How much is this hiring differential due to the difference in productivity-related characteristics and how much due to discrimination? Table 3.6 reports the results of decomposing the raw hiring differential into the endowment effect and the discrimination.

Table 3.6 Hiring Discrimination in the SOE sector

	Urban-weighted	Rural-weighted	Pooled sample weighted	Population-weighted
<i>No selectivity correction</i>				
Total diff	0.474 (0.010)	0.474 (0.010)	0.474 (0.010)	0.474 0.010
Explained	0.338 (0.044)	0.307 (0.048)	0.428 (0.009)	0.323 0.033
Unexplained	0.135 (0.045)	0.167 (0.048)	0.045 (0.005)	0.150 0.034
<i>Selectivity correction for hukou status</i>				
Total diff (adjusted)	0.547 (0.015)	0.547 (0.015)	0.547 (0.015)	0.547 0.015
Explained	0.201 (0.061)	-0.178 (0.113)	0.448 (0.011)	0.000 0.066
Unexplained	0.346 (0.066)	0.724 (0.120)	0.099 (0.010)	0.546 0.074

Note: The main entries represent the decomposition of the probability of being hired in the high wage SOE sector. Figures in parentheses are standard errors.

All specifications show that there exists obvious hiring discrimination against rural hukou holders in the SOE sector. According to the selectivity-adjustment decomposition, the unexplained differential in terms of the probability of being hired in the SOE sector is about 35% between urban and rural hukou holders (for urban-weighted decomposition). That is, rural hukou holders with identical observed characteristics have reduced probability of being hired in the high-wage sector than those with urban hukou.

Similar to the results of wage discrimination, the proportion of discrimination in total

hiring differential is larger with hukou-selectivity correction than without selectivity correction. Specifically, urban-weighted decomposition result shows that comparable workers with urban hukou are 13.5 percentage points more likely to be hired in the SOE sector than those with rural hukou without adjusting the selection issue, but the hiring differential becomes 35 percentage points if we take hukou selection issue into consideration.

To recapitulate, the econometric results presented in this section suggest that rural hukou holders not only face more wage discrimination in the SOE sector, but also suffer hiring discrimination in the high wage SOE sector in urban China.

3.7 Theoretical discussion

I have shown that there exists wage discrimination and hiring discrimination against rural hukou holders in urban China especially in state-owned enterprises. Although I cannot fully rule out the possibility that differences in unobserved characteristics between urban and rural hukou holders play a role in the unexplained part of decomposition, I have included many control variables and employed several robustness checks to support the conclusion.

However, how can we explain the reason for the discrimination? There are two main theories established to explain the existence of the discrimination against some group of workers, taste-based discrimination and statistical discrimination. The taste-based discrimination theory was developed by Nobel Laureate Gary Becker (1971). In Becker's framework, agents have tastes for discrimination with respect to groups of workers identified according to observed traits such as race, ethnicity, and gender. These tastes are purely based on preferences. The tastes for discrimination may come from employers, co-workers, or consumers. In our context, assuming there is employer discrimination against rural hukou holders in the SOE sector, and employers have a distaste for hiring workers with rural hukou, then employers do not maximize profits but rather maximize utility function which assigns disutility on hiring rural hukou holders.

Another possible explanation for our results is the statistical discrimination which maintains that employers use certain broad characteristics, such as gender, race or origin, when making decisions about individual recruitment where sufficient information does not exist or is costly to obtain. The pioneering work on this topic was done by Arrow (1973) and Aigner and Cain (1977). The wage discrimination found in this paper may arise from statistical discrimination, in that employers in the SOE sector think that migrants, as a group, are low skilled and less reliable. Employers' negative perceptions are likely to be used as stereotypes to discriminate against migrants (Chen and Hoy, 2011).

However, the theory of statistical discrimination cannot explain why the wage discrimination is more severe in the SOE sector than in the private sector.

Instead, in the taste-based model, the discrimination can sustain only if the market is not perfectly competitive. The competitive forces will drive out prejudiced firms. This is quite consistent with our finding in that SOEs can discriminate more because they are shielded from market forces. Since the SOE sector is commonly thought as part of government, the political power helps the SOE sector afford the discrimination against workers with rural hukou.

In summary, the findings in this paper are mostly consistent with the taste-based discrimination theory. The SOEs discriminate rural hukou holders more than the private firms do because they are protected by the government and shielded from competitive market forces.

3.8 Conclusions

In current China, we observe a simultaneous urban labor shortage and surplus labor in rural areas earning very low wage. Although previous studies have provided some explanations for this phenomenon, none of them have investigated the reason from labor

market perspective. This paper fills this gap and examines the hukou-based labor market discrimination in two segmented urban sectors including state-owned enterprises and private sector.

The results of this paper demonstrate that rural-to-urban migrants with rural hukou face both wage discrimination and hiring discrimination in urban China, especially in state-owned enterprises, which reduces their expected payoffs associated with migrating to the city. The paper offers an important reason for the co-existence of urban labor shortage and rural labor surplus.

Another significant contribution of this paper is that it employs a double-selectivity approach to investigate the extent of discrimination in urban China, which is the first attempt in discrimination literature in China. The first selectivity comes from the possibility that people with certain characteristics such as more government networking may be favored by state-owned enterprises (SOE) and thus more likely to work there. Another selection problem arises because the hukou status can also be endogenous in that some Chinese people are now allowed to convert their hukou from rural to urban upon meeting some criteria specified by each local government. The endogeneity of hukou status has never been dealt with or even considered in previous literature.

In summary, the econometric results using the preferred double-selectivity approach show that for observationally-equivalent workers, urban hukou holders earn about 50% more than rural hukou holders do in the SOE sector, but only 5% more in the private sector ($\rho \neq 0$, urban-weighted decomposition). In addition, all specifications show that there exists obvious hiring discrimination against rural hukou holders in the SOE sector. According to the selectivity-adjustment decomposition, the unexplained differential in terms of the probability of being hired in the SOE sector is about 35 percentage points between urban and rural hukou holders (for urban-weighted decomposition). That is, rural hukou holders with identical observed characteristics have reduced probability of being hired in the high-wage sector than those with urban hukou. Had a less sophisticated OLS specification been used instead, the estimated discrimination would have been much lower. This suggests that the adjustment for double selection issues is necessary.

I have to acknowledge that the regression-based decomposition technique has limitations on estimating the extent of discrimination since it is not possible to include all relevant individual characteristics and job-related features in regressions. However, this paper has tried to minimize the possibility that unobserved characteristics play a large role in explaining the wage differential by including as many control variables as the data set allows, such as school performance, health status, job training, firm size, and a set of dummies including occupation, industry, and province dummies.

To make the results more convincing, I have conducted various robustness checks including imposing different assumptions on the selection rules ($\rho=0$ or $\rho\neq 0$), trying alternative non-discriminatory wage structure, and using hourly wage as the dependent variable. All of my robustness checks lend the support to our major finding that rural hukou holders face more wage discrimination in the SOE sector than in the private sector, and also suffer hiring discrimination in the high wage SOE sector in urban China. This phenomenon can be best explained by the tasted-based discrimination theory. The SOEs discriminate rural hukou holders more than the private firms do because they are protected by the government and shielded from competitive market forces.

Appendix

Appendix 1: Data appendix

This section explains the definition of each variable used in this paper.

Hourly Wage. This is obtained from dividing the monthly earnings by the total number of hours worked in a moth.

Years of schooling. Years of formal education.

Experience. This is the potential work experience calculated by age minus years of schooling minus six.

Social capital. Measured by the number of greetings sent by the individual in the past Chinese new year festival.

Seniority. Defined as the number of years an individual has worked in the current organization, also referred as firm tenure.

Parent money. This means the total amount of money the individual received from his or her parents in the last twelve months.

Government reference. A dummy variable indicating whether the individual is recommended by the government for this job.

Number of Children. This information is obtained from the question “How many children have you ever had?”

Health status. An ordinal variable ranging from 1 to 5.

Height. Measured by centimeters.

Weight. Measured by kilograms.

School performance. This information is obtained from the question “How was your performance in your class before you last left school?” It is an ordinal variable ranging from 1 (very good) to 5 (very poor).

Gender. A dummy variable equal to 1 for males and 0 for females.

Marriage status. A dummy variable equal to 1 for the married and 0 for those not married.

Job training. A dummy variable equal to 1 for those who have received job training and 0 for those who have not.

Firm size. This is obtained from the question “How many employees are there in your work unit (including yourself)?”.

Occupation. This contains 25 occupation dummies.

Industry. This contains 29 industry dummies.

Province. This contains 9 province dummies since the survey was conducted in 9 provinces.

Appendix 2: Tables

Table A1 Log Wage Regressions with Selectivity Correction ($\rho=0$)

	SOE		Private	
	Urban hukou	Rural hukou	Urban hukou	Rural hukou
Years of schooling	0.016** (0.007)	0.060*** (0.020)	0.043*** (0.012)	0.040*** (0.011)
Experience	-0.007 (0.007)	0.035*** (0.012)	-0.004 (0.010)	0.029*** (0.006)
Exp. Sq	-0.0001 (0.0001)	-0.0009*** (0.0002)	-0.0001 (0.0002)	-0.0007*** (0.0001)
Male	0.304*** (0.047)	0.047 (0.065)	0.342*** (0.068)	0.082*** (0.030)
Social capital	0.0016*** (0.0003)	-0.0001 (0.0004)	0.001** (0.0004)	-0.0001 (0.0002)
Firm tenure	0.009*** (0.002)	0.024*** (0.008)	0.017*** (0.003)	0.023*** (0.004)
I_s	-0.084 (0.076)	0.559* (0.297)		
I_U	-0.237** (0.119)		-0.101 (0.113)	
I_P			0.447*** (0.109)	0.096 (0.347)
I_R		-0.110 (0.072)		-0.076* (0.043)
Constant	5.683***	3.615***	7.198**	5.682***

	(0.779)	(1.115)	(1.016)	(0.341)
N	1,646	464	869	2,355
Adjusted R-sq	0.2129	0.2672	0.2809	0.1843

Note: *** significant at 1%; ** significant at 5%; * significant at 10%. Figures in parentheses are standard errors. The dependent variables in all of wage equations are the natural logarithm of monthly earnings in 2007. All regressions have control variables as previously.

Table A2 Log Wage Regressions with Selectivity Correction ($p \neq 0$)

	SOE		Private	
	Urban hukou	Rural hukou	Urban hukou	Rural hukou
Years of schooling	0.016** (0.008)	0.062*** (0.022)	0.014 (0.011)	0.035*** (0.012)
Experience	-0.007 (0.008)	0.037*** (0.013)	-0.019* (0.010)	0.026*** (0.007)
Exp. Sq	-0.0001 (0.0001)	-0.0009*** (0.0002)	0.000 (0.0002)	-0.0006*** (0.0001)
Male	0.305*** (0.048)	0.055 (0.064)	0.378*** (0.068)	0.089*** (0.030)
Social capital	0.0017*** (0.0003)	-0.0001 (0.0004)	0.001** (0.0004)	0.0001 (0.0002)
Firm tenure	0.009*** (0.002)	0.023*** (0.008)	0.007*** (0.002)	0.021*** (0.004)
Constant	8.681*** (0.784)	3.800*** (1.087)	7.826** (1.019)	5.768*** (0.337)
N	1,646	464	869	2,355
Adjusted R-sq	0.2206	0.2309	0.2809	0.1842

Note: *** significant at 1%; ** significant at 5%; * significant at 10%. Figures in parentheses are standard errors. The dependent variables in all of wage equations are the natural logarithm of monthly earnings in 2007. All regressions have control variables as previously. Each regression also has two Tunali double-selectivity terms as in equation (16)-(19).

Table A3 Hourly Wage Decomposition without Selectivity Correction

		Urban-weighted	Rural-weighted	Pooled sample weighted	Population-weighted
SOE	Total diff	0.576 (0.026)	0.576 (0.026)	0.576 (0.026)	0.576 (0.026)

	Explained	0.445 (0.076)	0.399 (0.110)	0.528 (0.024)	0.438 (0.066)
	Unexplained	0.131 (0.079)	0.177 (0.113)	0.048 (0.015)	0.139 (0.069)
Private	Total diff	0.460 (0.021)	0.460 (0.021)	0.460 (0.021)	0.460 (0.022)
	Explained	0.420 (0.036)	0.368 (0.101)	0.416 (0.018)	0.387 (0.065)
	Unexplained	0.041 (0.040)	0.092 (0.102)	0.044 (0.010)	0.073 (0.067)

Note: The main entries represent the decomposition of log hourly wage differential. Figures in parentheses are standard errors.

Table A4 Hourly Wage Decomposition with Selectivity Correction

		Urban- weighted	Rural- weighted	Pooled sample weighted	Population- weighted
<i>Panel A Double selectivity ($\rho=0$)</i>					
SOE	Total diff (adjusted)	1.136 (0.509)	1.136 (0.509)	1.136 (0.509)	1.136 (0.509)
	Explained	-0.058 (0.223)	0.508 (0.375)	0.896 (0.408)	0.038 (0.196)
	Unexplained	1.194 (0.560)	0.627 (0.260)	0.239 (0.106)	1.098 (0.495)
Private	Total diff (adjusted)	1.050 (0.169)	1.050 (0.169)	1.050 (0.169)	1.050 (0.169)
	Explained	0.074 (0.296)	0.263 (0.134)	0.797 (0.108)	0.192 (0.139)
	Unexplained	0.976 (0.337)	0.787 (0.278)	0.252 (0.071)	0.857 (0.257)
<i>Panel B Double selectivity ($\rho \neq 0$)</i>					
SOE	Total diff (adjusted)	1.013 (0.483)	1.013 (0.483)	1.013 (0.483)	1.013 (0.483)
	Explained	0.469 (0.382)	-0.075 (0.226)	0.800 (0.388)	0.376 (0.319)
	Unexplained	0.545	1.088	0.213	0.637

		(0.245)	(0.538)	(0.100)	(0.267)
Private	Total diff (adjusted)	0.809	0.809	0.809	0.809
		(0.128)	(0.128)	(0.128)	(0.128)
	Explained	0.201	-0.258	0.580	-0.088
		(0.135)	(0.288)	(0.065)	(0.188)
	Unexplained	0.608	1.067	0.229	0.897
		(0.253)	(0.344)	(0.067)	(0.274)

Note: The main entries represent the decomposition of log hourly wage differential. Figures in parentheses are standard errors.

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Chapter 4 A Theoretical Model of the Chinese Labor Market⁶

4.1 Introduction

The purposes of this paper are to formulate a theoretical model to incorporate the most central features of the current Chinese labor market and to demonstrate how this model might be utilized to analyze the labor allocation as well as the wages in different economic sectors.

As Fields (2007) pointed out, good policy work requires sound theoretical foundations. Developing countries' labor markets are marked by distinct labor market sectors that work in different ways from one another and by complicated interrelationships among the sectors. In China's context, hitherto, very few studies have attempted to establish theoretical models for the Chinese labor market.

This is the major motivation for this chapter. This chapter intends to build a theoretical model which can incorporate the central features of the current Chinese labor market analyzed in Chapter 2 and 3. These features below from Chapter 2 will serve as a starting point for my analysis.

⁶ This paper is co-authored with Professor Gary Fields.

1. Nearly half of total labor force in China is working in rural areas and the other half is working in urban China; Within rural areas, more than one half of the rural labor force is still working in agriculture sector, and the rest is working in rural non-agriculture sector concentrated in eastern China; Within urban labor force, more than three quarters are working in private sector.

2. Urban and rural wages have been both increasing, but urban wages have grown much faster than rural wages, and now the average urban wage is approximately four times as high as the average rural wage.

3. Workers with different hukou face different costs of living in cities and have different access to government-provided public service and welfare programs in the urban area.

4. Workers with rural hukou earn lower wages and are less likely to be hired in the high-wage sector in urban areas compared to workers with local urban hukou due to both differences in human capital and labor market discrimination.

5. The phenomena of urban labor shortage and rural labor surplus are co-existent in the current Chinese labor market.

6. Open unemployment is low in China and is mainly concentrated in cities of central and western China.

7. There exists labor market segmentation between rural and urban labor market as well as within urban labor market between different ownerships

8. Wages in urban private sector are largely market-determined, and institutional interventions play a small role in wage-setting mechanism.

9. Skilled workers have experienced a much larger wage increase than unskilled workers.

10. Only about 10 percent of urban labor force in China is self-employed, but a substantial share of urban workers is not covered by social insurance programs.

This chapter formulates a theoretical model on China's labor market incorporating most of the features above, but not all of them. Extensions of the model including more features are possible for future research. According to Fields' criteria, good models should be those that contain enough sectors, provide realistic stylizations of the workings

of the labor markets in each sector, and contain reasonable specifications of the linkages between sectors in the country in question.

Previous studies have tried to employ the existent models to explain the Chinese labor market, but none of these models could capture the essence of unique features of the current Chinese labor market, and these models were not originally built in China's context. In addition, several scholars have attempted to build new models to fit the Chinese labor market. However, these models have various limitations and need to be further developed to fit the current reality.

Section 2 will provide a literature review of how the existing classic labor market models were used to analyze the Chinese labor market. In section 3, we will introduce some models that previous scholars have built with an intention to particularly fit China's labor market. Section 4 lists the features of our model, and the model will be formulated in section 5. Section 6 concludes.

4.2 Classic segmented labor market models

The majority of previous research on analyzing the Chinese labor market was based on one of the most famous model on labor market dualism, namely, the Lewis model

(1954). The model contains two economic sectors including the high-wage modern sector and low-wage agriculture sector, and has no unemployment. There are two phases in the Lewis model. In Phase 1, the modern sector faces an unlimited supply of labor due to the wage gap between modern and agriculture sectors, so no employers in the modern sector need to raise wages to attract additional labor. Thus, the wage in modern sector remains constant in the first stage. Finally, a turning point is reached once the supply of labor to the modern sector is no longer unlimited and subsequent economic growth would increase wages in the two sectors at the same rate in Phase 2 of the model. In summary, the first phase of the model features a constant wage in the modern sector and rising wage in the agriculture sector, while the second phase is characterized by wage increase in the two sectors at the same rate.

Although there are numerous studies on the debate about whether China has passed the Lewis turning point (Knight et al. 2011; Song and Zhang 2010; Lu and Jiang 2008), we claim that the Lewis model doesn't fit China because the Chinese reality does not hold either in Phase 1 or in Phase 2 of the Lewis model. Specifically, China has neither experienced a period in which urban wage keeps constant while rural wage rises (Phase 1 of the Lewis model), nor experienced a period in which rural and urban wages are the same and increase at the same rate (Phase 2 of the Lewis model). What we observe in China is that urban and rural wages have both been increasing, but urban wages have

grown much faster than rural wages. Accordingly, the whole discussion about whether China has passed or not passed the Lewis turning point is not well specified.

Another seminal segmented labor market model is the Harris-Todaro model (Harris and Todaro 1970). The model again has two sectors but allows for open unemployment. The two sectors of the economy are an urban sector and an agricultural sector. In their model, urban sector wage is set institutionally above the market-clearing wage and is assumed to be above the agriculture wage, as well. The institutional intervention on urban wage prevents full employment. The migration in this model is driven by the difference in the expected wages between urban and rural sectors. Therefore, the equilibrium condition of the model is that the expected wages between rural and urban search strategies are equal to each other. This model can explain the phenomenon of open unemployment in the urban area, and has been employed to analyze the effects of various public policies, such as urban employment creation and rural development (Fields 2005).

As it turns out, although all of the seminal models mentioned above have offered us insightful ideas on analyzing segmented labor market, they were all originally developed in other countries, rather than based on China's context. There is a need to build a theoretical model to particularly describe the Chinese labor market by incorporating unique institutional features.

4.3 Past research on modeling China's labor market

To date, only a few researchers have attempted to construct models for the Chinese labor market. The earliest model targeting on Chinese labor market was developed by Professor Xin Meng in her book called “Labor Market Reform in China” published in 2000. Based on Fields’ model, Meng (2000) developed a three-sector model to elaborate the relationship among rural-urban migration, employment, and wage levels in both rural and urban areas in China. The three sectors include rural sector, urban formal sector, and urban informal sector.

The key assumptions of this three-sector labor market model are listed below:

1. There exists institutional restriction on rural-urban migration;
2. All urban residents work in the formal sector and migrants can be employed only in the informal sector;
3. Firms pay higher wage in the formal sector than in the informal sector for the same work;
4. The informal sector is a market sector and pays the market-clearing wage, whereas firms in the formal sector pays high-than-market-clearing wage;
5. All jobs in the formal and informal sector are technically homogenous, both within

sectors and across sectors;

6. Workers are homogenous in terms of skills, but differ in terms of residential status;

7. The informal sector and rural sector both pay the market-clearing wage, but the wage in the urban informal sector is assumed to be higher than that in the rural sector.

8. There is no open unemployment.

Putting the three sectors into the same diagram, Figure 4.1 illustrates the interaction between rural-urban migration and the labor market condition in the whole economy. The two vertical axes represent rural and urban wages, and the horizontal axis measures labor input. $D_r D_r$ denotes the labor demand curve for rural sector. $D_m D_m$ is the real MPL curve for the urban formal and informal sectors. However, as the formal sector is paying employees higher wages than their MPL, the labor demand curve for the formal sector is $D_u D_u$. Therefore, the total labor demand curve for urban sectors is thus the kinked curve $D_u a b D_m$, with the urban formal sector employing $O_u L_2$ amount of labor and the wage level for this sector being set at W_u . Because of differences in residential status, the labor supply curve for urban residents is S_u , and the total urban labor supply is S_t .

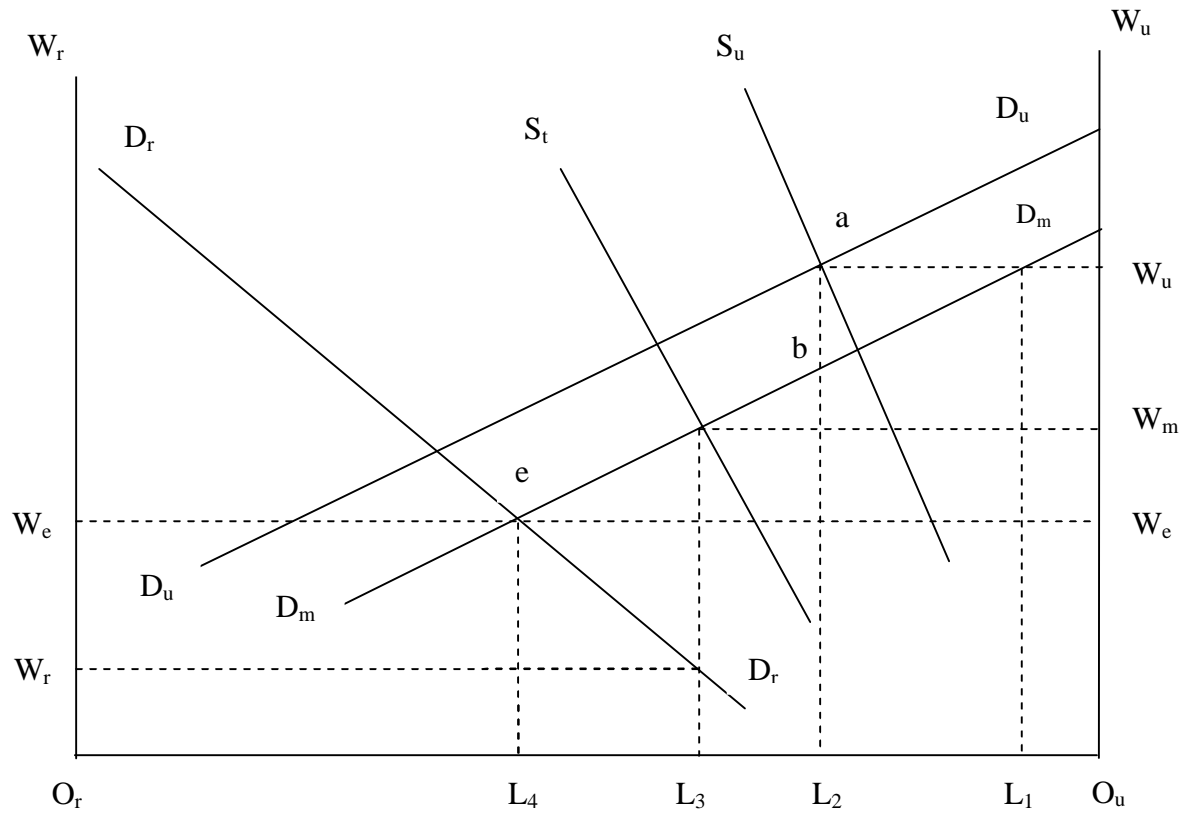


Figure 4.1 Three-Sector Labor Market Model (Meng, 2000)

As the real market demand curve in urban areas should be $D_m D_u$, rather than $D_u D_u$, the urban sector's real demand for the urban residents at wage W_u is $O_u L_1$. Meng defines the hidden unemployment in urban formal sector as the actual quantity of labor working in the urban formal sector minus the quantity of labor demanded in this sector according to the real demand curve. Thus, Meng argued that the institutional intervention on the wage of urban formal sector generates a hidden unemployment of $L_1 L_2$.

What is the labor allocation between the urban informal sector and rural sector?

Recall that this model assumes that migrants could also take informal jobs in urban areas, so if there is no restriction on rural-urban migration, the urban informal sector will employ L_2L_4 migrants and the rural sector employ O_rL_4 amount of labor. However, this is not the case. Institutional barriers and transaction costs prevent rural labor from moving to the urban informal sector to the point L_4 . Instead, rural-urban migration stops at the point L_3 , the intersection of the total labor demand curve for urban sectors and the total urban labor supply curve. Therefore, the actual employment in the urban informal sector and rural sector are L_2L_3 and O_rL_3 , respectively. Given the assumptions, there are three different wages levels in this economy, W_u , W_m , and W_r for urban formal sector, informal sector, and rural sector, respectively.

Meng claimed that if the segregation between urban residents and rural migrants did not exist, other things constant, the urban wage would be equal to W_m , which is lower than the current average urban wage. Thus, the smaller the barrier to migration, and the less rigid the urban formal sector, the lower the urban labor costs. Indeed, if all of institutional constraints were removed, then the wage would be equalized across the three sectors, and the unique economy-wide wage would be equal to W_m . Furthermore, the problem of hidden unemployment would be eliminated if the urban formal sector pays the market-clearing wage.

Although Meng's model incorporates some unique feature of the Chinese labor market, such as institutional restriction on rural-urban migration, it is not very rigorous and also has several limitations. For example, the definition of total labor demand curve for urban sectors $D_u + D_m$ in this model actually violates the definition of demand curve, because a given wage is corresponding to multiple quantities of labor demanded. In addition, Meng's model assumes that urban residents only take formal jobs, and informal jobs are merely filled in by migrants. Nonetheless, this assumption is too strict to fit the reality. On the one hand, Cai and Wu (2006) examines how common urban permanent residents are employed on an informal basis. They analyzed survey data collected by the Ministry of Labor in 66 cities nationwide at the end of 2002. The survey concentrated nearly exclusively on urban permanent residents. The authors applied multiple criteria to determine if an individual worker was employed informally. The most important categories are those who are self-employed workers, those who work on a temporary or hourly basis, and those who lack a labor contract and are not considered officially registered workers. The result is quite striking. They find that 45 percent of employment of urban residents is informal in nature. On the other hand, we do observe many migrants working in urban formal sector covered by social insurance system in Chapter 1. Finally, the fifth assumption that jobs across formal sector and informal sector are technically homogenous is not realistic. It is hard to imagine that an informal job such as selling

newspapers in the street has the same technical nature as a formal job such as computer engineer.

Laing et al (2005) extended the basic H-T model to a search equilibrium setting that includes both legal and illegal migrants, and concluded that the stricter enforcement of hukou system may reduce urban unemployment. However, this model was built for the Chinese labor market in the 1990s, when the labor mobility was controlled by departments of public security and it was illegal for rural residents to move to cities without official approval. As mentioned in the first chapter, this strict restriction on labor mobility has been relaxed in China. Currently, Chinese workers are free to move and work in any place within China as long as they can find a job there. Accordingly, any internal migration is legal regardless of a worker's *hukou* status. The *hukou* system has lost its significance on strictly prohibiting Chinese workers from migrating to places different from where they were born.

Additionally, Seeborg, Jin and Zhu (2000) made another extension of the H-T model by incorporating the dual nature of state and non-state employment in Chinese urban cities. They break down urban formal labor into two sectors: the SOE (State-owned enterprises) sector and the non-SOE sector. Nevertheless, they only provided a conceptual model but failed to include details such as how the wages in each sector are determined.

Beyond Meng's model and other segmented labor market models, the present paper establishes a rigorously theoretical model on current China's labor market, and makes at least three contributions to the literature. First, the model contains three economic sectors, provides more realistic stylizations of the workings of the labor markets in each sector, and contains more reasonable specifications of the linkages between sectors. For instance, the model reflects the current feature that both urban and rural hukou holders are working in each of the two urban sectors, which was not allowed in Meng's model.

Second, the model constructed in this paper incorporates the role of the current hukou system in China's labor market. Based on some very recent empirical papers on the Chinese hukou system, the model captures the stylized fact that workers with different hukou are treated differently in the urban labor market, face different costs of living in cities, and have different access to government-provided public service in the urban area. Almost all of the previous literature on modeling the Chinese labor market only claimed that hukou system is a major institutional restriction on labor mobility, but did not analyze how it actually works. The hukou system was similar to a black box which previous researchers had never explored for the purpose of modeling the Chinese labor market.

Last but not the least, this paper utilizes the model to analyze the welfare consequences of various labor market policies using two well-specified welfare evaluation criteria: first-order stochastic dominance approach and abbreviated social welfare function. Some researchers have tried to conduct policy analysis on the Chinese labor market (Hertal and Zhai 2006; Ito 2008). However, these studies either explicitly or implicitly use the magnitude of rural-to-urban migration as a policy evaluation criterion. They essentially hold the opinion that policies which would promote rural-to-urban migration are desirable and welfare-improving. We claim that this criterion is not appropriate because there is no economic or moral reason to simply judge whether the migration is good or not for people's economic well-being in a country. In contrast, this present paper employs well-defined welfare criteria to analyze the effects of labor market policies. The unprecedented result of this paper will give Chinese policy makers a crucial guidance about how to design labor market policy in order to improve social welfare.

To recapitulate, in comparison with the previous literature, we construct a theoretical labor market model for current China containing more fully-specified labor markets and inter-market linkages and incorporating the role of the current hukou system, obtain a closed form solution before modeling any policy interventions, and work out welfare consequences of the various possible policy interventions.

4.4 Features of our model

4.4.1 Two locations: urban and rural area

The model has two locations: a single urban area and a single rural area. The urban area is corresponding to a city in eastern China, such as Shanghai, or Beijing, and the rural area is in central or western China. As is known, the eastern part of China is richer than the central or western China. In fact, the majority of rural-to-urban migrants are located in eastern cities to pursue higher income compared to central and western China. Thus, the model reflects the most typical migration pattern in current China, from central or western rural area to eastern urban area. There is no differentiation within urban and rural areas.

4.4.2 Three segmented employment sectors

There are three sectors in total in the whole economy, including state-owned enterprises (SOE), private firms, and agriculture sector. The SOE and private sectors are located in the urban area, and the agriculture sector is in the rural area.

The various sectors differ from one another in two major respects: wages and job search opportunities. It is documented in empirical literature that for comparable workers, the SOE sector pays the highest wages, with private sector in middle and agriculture at

bottom (Song and Li 2010; Yang 2010). The detailed definitions and explanations of each sector are as follows.

4.4.2.1 SOE sector labor market

The wages paid to workers with each hukou in the SOE sector are set exogenously by the government for political reasons and higher than the market-clearing levels as well as wages in any other sectors. As a result, all workers want to have a job in the SOE sector, because it pays higher wages than any place else. However, since the SOE sector labor market does not clear, it does not hire all of the people who want to work there.

The SOE sector employers discriminate against rural hukou holders, taking the form of both wage and hiring discrimination. According to the results in Chapter 3, for observationally-equivalent workers, urban hukou holders earn about 50% more than rural hukou holders do in the SOE sector. In addition, urban hukou holders are found nearly 50% more likely to work in the SOE sector than rural hukou holders, and a large portion of this hiring differential can be attributed to hiring discrimination in the SOE sector. That is, rural hukou holders with identical observed characteristics have reduced probability of being hired in the high-wage sector than those with urban hukou. The state-owned enterprises can afford discrimination because they are shielded from market forces. Since the SOE sector is commonly thought as part of government, the political power helps the

SOE sector afford the discrimination against workers with rural hukou

Foreign-invested enterprises are excluded from the model. It has been shown that the wage level in foreign-invested enterprises is similar to that in the state-owned enterprises and also higher than the market-clearing wage (Chen et al. 2005). Therefore, our model can be simply extended to include foreign-invested enterprises as part of the SOE sector.

4.4.2.2 Private sector labor market

The private sector labor market clears for both rural and urban hukou holders, and therefore all the labor supplied to that sector is employed. Given the empirical features obtained in previous chapters, the private sector wage in China is largely market-determined, and institutional interventions such as minimum wage or labor unions play a small role in wage-setting mechanism.

All workers located in the urban area who do not get employed in the SOE sector supply their labor to the private sector. Because the private sector pays the market-clearing wage, anybody who does not get a SOE job is able to obtain a job in the private sector and work there, regardless of this person's hukou status. Thus, there is no open unemployment in the urban area.

Private sector employers are not discriminatory. We know from Chapter 3 that the average wage differential between urban and rural hukou holders is very small in private firms, and furthermore, a large proportion of the wage differential can be explained by different human capital between the two groups of workers.

The model does not have an urban self-employment sector for the two following reasons. One is that self-employment in urban China has become less popular. Second, we don't consider self-employment in the urban area as a separate sector because the wage differential between workers in private firms and the self-employed is very small after controlling for characteristics (Giulietti et al. 2012). Therefore, self-employment can be thought as part of the private sector in the model.

4.4.2.3 Agricultural sector labor market

This labor market is characterized by self-employment. In central and western China, a person located in the rural area is automatically allocated a piece of land. Farmers cultivate crops on their own land and sell the products. Feng (2008) said that the land rental market is still in its infancy. Thus, self-employment is still popular in poor rural areas. Furthermore, we assume that all agricultural sector workers earn the same self-employment wage as each other.

In addition, following the assumption by Fields (1975) and Stiglitz (1982), our model assumes that the wage in rural agriculture sector is invariant with respect to agriculture labor force. This assumption makes some sense because in the context of self-employment, an agriculture worker can almost produce the same amount of product with the available land allocated to each person.

We exclude the rural non-agricultural sector from this model, since the rural non-agricultural enterprises are mainly concentrated in rural areas of eastern China (Ash 2010). Again, the model only consists of a single rural area in central or western region, and a single urban area in eastern region of China.

4.4.2.4 Inter-market linkages

Any worker in this economy has two possible search strategies, either going to the urban area and searching jobs there or going to the rural area and accepting the agricultural wage. Workers with urban hukou have one pair of payoffs for urban versus rural search, and workers with rural hukou have a different pair of payoffs for urban versus rural search.

This model does not allow for on-the-job search. That is, any person who wants to work in the city has to be physically located in the urban area and search for urban jobs.

People who adopt the rural search strategy can only accept the agriculture wage and have no chance of being hired for an urban job.

Workers allocate themselves among two search strategies in order to maximize expected discretionary income by choice of search strategy. The assumption of expected wage equalization in the equilibrium was made by most of previous seminal models (Harris and Todaro 1970; Fields 1975). The terminology of the expected discretionary income differs from expected wage in that it takes into account other benefits and costs associated with each search strategy. The benefit may include various government-provided welfare benefits, and the cost refers to the cost of living in the destination. In the equilibrium, workers have equal expected discretionary income among different search strategies.

4.4.3 The role of hukou system in the labor market

Everybody in this model has urban or rural hukou, with which they are endowed and cannot change. Currently, the most important determinant of a person's *hukou* type when the person was born is parental *hukou* types (Chan, 2010). One's *hukou* status would remain unchanged no matter where the individual physically moved, unless he or she goes through a formal procedure of *hukou* conversion. However, many large cities in eastern China which are the main destinations of rural-to-urban migrants put up the most

stringent entry conditions to grant local urban *hukou*. The present *hukou* conversion policy in big cities is almost totally geared towards the super rich and the highly educated and is irrelevant to most of rural-to-urban migrants. The strict requirements of *hukou* conversion are clearly beyond their reach. Therefore, in this paper, we assume that people cannot change their *hukou* status.

Although people are free to move between urban and rural areas within China, rural *hukou* holders have very little access to public services and welfare benefits provided by city governments, and have to pay a higher cost of living in the city than urban *hukou* holders do. The current *hukou* system is related to the access to a variety of public service and welfare programs, such as children education, medicare, housing subsidies, social security coverage, and so on. In current China, most of public service and welfare benefits are attached to a person's *hukou* status, rather than the physical location. One can physically move to a new place but can be permanently barred access to local services and welfare programs.

Moreover, there is a big difference in cost of living in the city between workers with rural and urban *hukou*. Rural migrants either have been denied some basic urban services, or can obtain only low-quality services at high cost. For instance, the children of rural migrants have to pay a very high fee to attend public schools in the destination city (Chen

and Yang 2010).

Additionally, our model assumes that workers with urban hukou are inherently more productive than rural hukou holders for urban jobs, because rural hukou holders on average have less human capital than urban hukou holders. The rationale of this feature is that people in rural China receive less and relatively poorer-quality education than urban areas (Song 2012).

Finally, as discussed previously, rural hukou holders face wage and hiring discrimination in the urban SOE sector. The wage discrimination implies that rural hukou holders' efficiency units of labor are rewarded less than equally productive efficiency units of labor for urban hukou holders. Besides, rural hukou holders also face hiring discrimination in the urban SOE sector meaning that they get hired with reduced probability compared to urban hukou holders.

4.4.4 No unemployment

There is no unemployment in the whole economy of the model. In rural China, the *Household Responsibility System* (HRS) guarantees that everybody has his or her share of land, so it is a reasonable assumption that rural unemployment is as low as negligible since workers can easily work on a piece of land to have a job in agriculture sector. In

slack seasons, many workers choose part-time job in urban areas (Chen et al. 2010). Even for people staying in rural areas during the slack seasons, if they are not actively searching for jobs, they would not be counted as the unemployed. The only effect of non-working in slack seasons is a reduction in labor participations rate, but not an increase in rural unemployment. Thus, it makes sense to claim that rural unemployment does not exist.

On the other hand, as observed in empirical literature, urban areas in eastern China are facing a labor shortage, rather than a labor surplus (Chan 2010). Therefore, in our model with only a single urban in eastern China, there is no urban unemployment as well.

This section has summarized four features that will be included in the model. The next section will provide mathematical specifications of each feature and obtain closed-form solutions to the entire model.

4.5 Model specification

The previous section summarized the main features of our model. In this section, we provide the specific mathematical equations incorporating these features and obtain closed form solutions for each of the employment and wage levels.

The economy in this model consists of a large number of risk-neutral individuals and three economic sectors. There are two sectors in the urban area, the SOE and private sector, and only one sector in the rural area, which is the agricultural sector. Firms within each sector are identical and have the same production functions.

Any person in this economy has one of the two hukou statuses, either rural or urban hukou. Let L be the total number of workers in this economy. Among these workers, there are L^U workers with urban hukou, and L^R workers with rural hukou. These two numbers are set exogenously by the government and will keep unchanged in the following model. The labor endowment equation is specified in equation (1):

$$(1) \quad L^U + L^R = L.$$

As discussed above, workers with urban hukou have more human capital and thus are inherently more productive than rural hukou holders for urban jobs. Following the convention from previous literature, we use efficiency units of labor to reflect this productivity differential (Saint-Paul, 1994; Razin and Sadka, 1995). Assume that a worker with urban hukou is endowed with one efficiency unit of labor, regardless of whether this person works in the city or in the rural area. In contrast, a rural hukou holder

can provide only $b < 1$ efficiency units of labor if he works in the city, and one efficiency unit of labor if he works in the rural area for agricultural work. That is, workers with different hukou are inherently equally productive for agriculture work in the rural area, but have different productivity for urban jobs.⁷ Efficiency units of labor are the only factor of production in each sector.

4.5.1 SOE sector labor market

The wages paid to workers with each hukou in the SOE sector are set exogenously by the government for political reasons and higher than the market-clearing wages. Let W_s^U and W_s^R stand for the wages for urban and rural hukou holders in the SOE sector, respectively. The superscript denotes the hukou type, and the subscript refers to the economic sector. Accordingly, the wages per worker with each hukou type in the SOE sector are exogenously determined as follows.

$$(2) \quad W_s^U = \bar{W}_s^U .$$

$$(3) \quad W_s^R = \bar{W}_s^R .$$

Taking wages of each type of workers as given, firms in the SOE sector decide how many workers with each hukou status to hire. Firms in the SOE sector discriminate

⁷ A more reasonable assumption would be that rural hukou holders are more productive than urban hukou holders for rural agriculture jobs. However, this assumption would not affect the results of this paper.

against rural hukou holders, practicing both wage and hiring discrimination. Specifically, wage discrimination refers to the fact that the SOE sector pays higher wages to each efficiency unit of labor with urban hukou than each efficiency unit of labor with rural hukou. Since each urban hukou holder has one efficiency unit of labor for the job in the SOE sector, and a rural hukou holder has only $b < 1$ efficiency units of labor, wage discrimination against rural hukou holders implies:

$$(4) \quad W_s^U > \frac{W_s^R}{b}.$$

The left hand side of the equation above denotes the wage for one efficiency unit of labor with urban hukou, while the right hand side is equal to the wage for one efficiency unit of labor with rural hukou. Equation (4) implies that the wage differential between workers with urban and rural hukou in the SOE sector is not only caused by the productivity differential, but also by the different treatment to the equally productive efficiency units of urban and rural labor in the SOE sector.

Moreover, rural hukou holders also face hiring discrimination in state-owned enterprises in that SOE sector employers maximize utility, which is a function of profits and also disutility of hiring rural hukou holders. This specification is similar to the framework proposed by Becker's (1971) model of employer discrimination. In Becker's

original model, the disutility is linear in the number of discriminated workers. However, several papers have argued that this linear specification can either lead to full segregation or indeterminacy of the demand functions (Prieto-Rodriguez et al., 2008; Hellerstein et al., 2002; Neumark, 1988). They claimed that a more reasonable assumption is that the total disutility is a convex function in the number of discriminated workers.

We follow the convention in the literature and assume that the marginal disutility is increasing as more and more rural hukou holders enter the SOE sector. For analytical convenience, we employ a simple quadratic form for the disutility of hiring rural hukou holders. Let E_s^U and E_s^R denote the total number of workers with urban and rural hukou demanded by firms in the SOE sector, respectively. Firms in the SOE sector have the same discrimination coefficients denoted by d , and maximize the utility function as follows by choosing how many workers of each hukou type to hire.

$$(5) \quad \text{Max } U = f_s(E_s^U + bE_s^R) - W_s^U E_s^U - W_s^R E_s^R - d(E_s^R)^2.$$

The price of the output in the SOE sector is normalized to 1. $f(\cdot)$ is a typical production function, with $f' > 0$, and $f'' < 0$. In order to obtain closed form solutions to the maximization problem above, we need to specify the production function in the SOE sector. For mathematical tractability, we choose a left half parabola as the functional form

for the production function. For our purposes, the quadratic specification on the production function has at least two advantages. First, it is a strictly increasing and concave function, which satisfies the conditions for a typical neo-classical production function. Second, it is sufficiently simple to allow for the derivation of closed form solutions. Thus, we have

$$(6) \quad E_s = E_s^U + b E_s^R.$$

$$(7) \quad f_s = -(E_s - a)^2 + b, \quad a > E_s^{MAX} > 0.$$

E_s denotes the number of efficiency units of labor demanded by the SOE sector, and consists of two terms as shown above. Given this production function, with a and b being positive parameters, we can solve for the utility maximization problem specified in equation (5). The following two equations stand for the solutions to the number of rural and urban hukou holders demanded in the SOE sector, respectively.

$$(8) \quad E_s^{R*} = \frac{b\bar{W}_s^U - \bar{W}_s^R}{2d},$$

$$(9) \quad E_s^{U*} = a - \frac{1}{2} \bar{W}_s^U - b \frac{b\bar{W}_s^U - \bar{W}_s^R}{2d}.$$

4.5.2 Private sector labor market

Private sector employers are not discriminatory, so each efficiency unit of labor is rewarded the same in the private sector regardless of the holder's hukou status. Let the wage per efficiency unit of labor in the private sector be equal to W_{NS} . We use "NS" (non-SOE) to denote the private sector from now on, reserving "P" for probabilities in later sections. Since efficiency units of labor are the only factor of production in the model, private sector employers as wage takers will merely determine how many efficiency units of labor to employ. Let E_{NS} denote the number of efficiency units of labor demanded and therefore employed by the private sector. Accordingly, firms in this sector with production function $g(\cdot)$ maximize the following profit function:

$$(10) \quad \Pi_{NS} = g(E_{NS}) - W_{NS} E_{NS}.$$

$$(11) \quad E_{NS} = E_{NS}^U + b E_{NS}^R.$$

Again, the product price is normalized to 1. $g(\cdot)$ is an increasing, concave production function, with $g' > 0$, and $g'' < 0$. E_{NS}^U and E_{NS}^R denote the total number of workers with urban and rural hukou demanded by firms in the private sector, respectively. In order to obtain closed form solutions analytically, we assume that the production function in the private sector takes the natural log form with parameter A as follows.

$$(12) \quad g_{NS} = A \ln(E_{NS}), A > 0.$$

Given this production function, we can get the demand function for labor in the private sector as follows by solving for the profit-maximizing level of employment:

$$(13) \quad E_{NS}^* = \frac{A}{W_{NS}}.$$

By assumption, all workers located in the urban area who do not get employed in the SOE sector supply their labor to the private sector. The private sector labor market clears for both rural and urban hukou holders, and therefore all labor supplied to that sector is employed. The market-clearing conditions in the private sector for workers with each hukou status are specified as follows in equations (14) and (15). L^U denotes the total number of urban hukou holders in the economy, and L_U^R stands for the number of job seekers in the urban area with rural hukou. The superscript refers to the hukou status, and the subscript is the job location.

$$(14) \quad L^U - E_S^U = E_{NS}^U.$$

$$(15) \quad L_U^R - E_S^R = E_{NS}^R.$$

Since an urban hukou holder provides one efficiency unit of labor for any urban job, the wage for a worker with urban hukou in the private sector is equal to W_{NS} . A rural

hukou holder is endowed with only b efficiency units of labor, and so the wage for a worker with rural hukou in the private sector is equal to b times the wage per efficiency unit of labor in the private sector. Hence, the wages for urban and rural hukou holders in the private sector are determined as follows such that the market-clearing conditions in equations (14) and (15) are satisfied, respectively.

$$(16) \quad W_{NS}^U = W_{NS}^* .$$

$$(17) \quad W_{NS}^R = b W_{NS}^* .$$

4.5.3 Agricultural sector labor market

As discussed previously, the wage in agricultural sector is invariant with respect to the size of the agricultural sector labor force, and anyone who wishes to enter the agricultural sector can take up self-employment and earn a wage W_A regardless of hukou status. Because any person has one efficiency unit of labor for agriculture work, people with different hukou earn the same wage equal to W_A .

4.5.4 Inter-market linkages

4.5.4.1 Search strategies

Any worker in this economy has two possible search strategies, either going to the urban area and searching for jobs there or going to the rural area and accepting the agricultural wage. Denote L_U^U as the number of job seekers in the urban area with urban hukou. The superscript refers to the hukou status, whereas the subscript stands for the geographical location where people are looking for jobs. Similarly, L_U^R , L_R^U , and L_R^R follow the same notation, and the two equations below reflect the labor endowment for urban and rural hukou holders, respectively.

$$(18) \quad L^U = L_U^U + L_R^U.$$

$$(19) \quad L^R = L_U^R + L_R^R.$$

(1) Search strategies for workers with urban hukou

For urban hukou holders, two search strategies are possible. The first strategy is to stay in cities and search for urban jobs, and the second one is go to rural areas and earn the agricultural wage. Denote the probability of a given urban hukou holder being employed in the SOE sector by P_S^U . This probability is endogenous and will be discussed in more detail later. If a person fails to obtain a job in the SOE sector, he or she will immediately go to the private sector and work there. The market-clearing condition in the private sector guarantees that any person who wants to work in the private sector will be able to find a job in this sector. Therefore, the expected wage of the first search

strategy for a worker with urban hukou $E(W_U^U)$ satisfies the following equation (20):

$$(20) \quad E(W_U^U) = W_S^U P_S^U + W_{NS}^U (1 - P_S^U).$$

Again, the superscript refers to the hukou status, and the subscript stands for the job location. The first term on the right hand side of (20) is the expected wage from the SOE sector, and the second term equals the expected wage from the private sector conditional on failing to get a job in the SOE sector.

Since we assume there is no unemployment in rural areas either, any urban resident who chooses the second search strategy will earn W_A .

(2) Search strategies for workers with rural hukou

Similarly, workers with rural hukou also have two search strategies. The first strategy is to migrate to cities and search for urban jobs, and the second is to stay in rural areas and earn the agricultural wage. Denote the probability of a rural migrant becoming employed in the SOE sector by P_S^R . Consequently, the expected wage of the first search strategy for a worker with rural hukou $E(W_u^R)$ consists of two terms, the first term equal to the wage in the SOE sector for a rural hukou holder multiplied by the probability of being hired in the SOE sector for a worker with rural hukou, and the second term

equaling the wage in the private sector times the probability of working in this sector. The expected wage associated with migrating to the urban area for a rural hukou holder can thus be described in the following equation.

$$(21) \quad E(W_u^R) = W_S^R P_S^R + W_{NS}^R (1 - P_S^R).$$

On the other hand, any rural hukou holder who chooses the second search strategy will earn W_A , so the expected wage of the second strategy is W_A .

(3) Probabilities of employment

We turn our attention now to the probabilities of employment in the SOE sector for workers with different hukou statuses. The probability of a given worker being hired in the SOE sector is calculated as the ratio of jobs in the SOE sector available to this type of worker divided by the number of job seekers with that hukou type in the SOE sector. Specifically, the probability of a worker with urban hukou becoming employed in the SOE sector, P_S^U , is equal to the total number of jobs available to urban hukou holders in the SOE sector divided by job seekers with urban hukou:

$$(22) \quad P_S^U = \frac{E_S^U}{L_U^U}.$$

The corresponding probability for workers with rural hukou is calculated in the same way:

$$(23) \quad P_S^R = \frac{E_S^R}{L_U^R}.$$

4.5.4.2 Expected discretionary income

Workers allocate themselves among search strategies in order to maximize expected discretionary income by choice of search strategy. As said earlier, the terminology of the expected discretionary income differs from expected wage in that it takes account of other benefits and costs associated with each search strategy. Specifically, the costs of working in the city for rural hukou holders should include both the cost of moving to the city and the cost of living in the city. In fact, the transportation cost of moving to cities is very low in current China, and so we ignore it. Therefore, we refer here only to the cost of living in the city, which is a one dimensional variable measured by its value in monetary terms. In order to capture the big difference in cost of living in the city between workers with rural and urban hukou, without loss of generality, we assume that the cost of being in the city for urban hukou holders is equal to zero while C^R denotes the extra cost of living in the city for a rural hukou holder. This cost is exogenously determined and the same for all rural hukou holders in the city.⁸

⁸ In reality, this cost can vary among rural hukou holders. For example, workers with children have to bear the education cost, but workers without children need not pay this cost. Indeed, the difference of this cost may partly explain why more young people choose to migrate while older people tend to stay in the rural area. The model developed here can be easily extended to incorporate this feature.

On the other hand, the current hukou system is related to the access to a variety of public service and welfare programs. Let S^U and S^R denote the values of government-provided benefits associated with urban and rural hukou, respectively, including housing subsidies, social security programs, and so forth. These benefits do not have subscripts because they are not linked to the physical location but are only based on hukou status. In China, the benefits associated with urban hukou are much larger than those associated with rural hukou. That is, $S^U > S^R$. For analytical convenience, we normalize these benefits so that $S^R = 0$.⁹

Now we can write down the expressions of expected discretionary income associated with each search strategy for workers with different hukou. For an urban hukou holder, the expected discretionary income associated with staying in the urban area is equal to the expected wage plus the government-provided benefits related to urban hukou. Since this benefit will remain the same even if the urban hukou holder migrates to the rural area, the expected discretionary income associated with migrating to the rural area is equal to this benefit plus the expected wage in the rural area. Equations (24) and (25) give us the expressions for these expected discretionary incomes for workers with urban hukou. DI_U^U and DI_R^U stand for the discretionary incomes for an urban hukou holder in the

⁹ For policy interventions in later sections, a reduction in C^R is indeed equivalent to an increase in S^R . So the reduced cost policy can also be thought as increased benefit policy.

urban and rural area, respectively.

$$(24) \quad E(DI_U^U) = E(W_U^U) + S^U,$$

$$(25) \quad E(DI_R^U) = E(W_R^U) + S^U.$$

Similarly, the expected discretionary incomes associated with each search strategy for workers with rural hukou are specified in the following.

$$(26) \quad E(DI_U^R) = E(W_U^R) - C^R,$$

$$(27) \quad E(DI_R^R) = E(W_R^R).$$

4.5.5 Model solutions in equilibrium

We claim that in equilibrium, rural hukou holders have the same expected discretionary income associated with two search strategies. The reason for this claim is the empirical fact that large numbers of rural hukou holders are working in the city and large numbers stay in rural areas. In other words, some rural hukou holders choose the first search strategy and others choose the second one, so neither strategy is dominant. The equilibrium condition for rural hukou holders is thus characterized by equalization of expected discretionary incomes, as in the following equation:

$$(28) \quad E(DI_U^R) = E(DI_R^R).$$

Given that the solution to the equilibrium for rural hukou holders is interior, we can prove that urban hukou holders have a corner solution in the equilibrium in that the expected discretionary income associated with staying in the city is unambiguously larger than that associated with migrating to the rural area. Specifically, we have the following result, the detailed proof of which can be found in Appendix 1:

$$(29) \quad E(DI_U^U) > E(DI_R^U).$$

That is, all urban hukou holders choose to stay in the city and take urban jobs. This is quite consistent with the empirical reality that very few urban hukou workers actually choose to move to rural areas due to the availability to better-paying urban jobs (Gagnon et al., 2012). Accordingly, we can derive the following equilibrium results for urban and rural hukou holders, respectively:

$$(30) \quad L_R^{U*} = 0.$$

$$(31) \quad W_A = W_S^R \frac{E_S^R}{L_U^R} + W_{NS}^R \left(1 - \frac{E_S^R}{L_U^R}\right) - C^R.$$

The model specified in equations (1) through (31) can be analytically solved. Given the exogenously determined wages in the SOE and rural sector (\bar{W}_S^U , \bar{W}_S^R , W_A), labor endowment with each hukou status, and the cost of being in the city for rural migrants C^R , we can solve the equilibrium employment and wages in different sectors for different hukou holders.

We have solved for some of wages and employment levels. Let us show the solutions to the remaining wages and employment levels to close the model. The solved wages in the private sector for urban and rural hukou holders are presented in equations (32) and (33), and employment levels in the urban private sector and rural agriculture sector are demonstrated in equations (34) to (36), respectively. The values of E_{NS}^{R*} and L_U^{R*} in equations (32) through (36) are expressed in equations (37) and (38). The derivations of these solutions are available from the authors upon request.

$$(32) \quad W_{NS}^{U*} = \frac{A}{L^U + bL_U^{R*} - E_S^*}.$$

$$(33) \quad W_{NS}^{R*} = b \frac{A}{L^U + bL_U^{R*} - E_S^*}.$$

$$(34) \quad E_{NS}^{U*} = L^U - \left(a - \frac{1}{2} \bar{W}_S^U - b \frac{b\bar{W}_S^U - \bar{W}_S^R}{2d} \right).$$

$$(35) \quad E_{NS}^{R*} = L_U^{R*} - \frac{b\bar{W}_S^U - \bar{W}_S^R}{2d}.$$

$$(36) \quad E_R^{R*} = L_R^{R*} = L^R - L_U^{R*}.$$

$$(37) \quad E_S^* = a - \frac{1}{2} \bar{W}_S^U.$$

$$(38)$$

$$L_U^{R*} = \frac{\left[bE_S^{R*}\bar{W}_S^R + bA - (W_A + C^R)(L^U - E_S^*) \right] + \sqrt{\left[bE_S^{R*}\bar{W}_S^R + bA - (W_A + C^R)(L^U - E_S^*) \right]^2 + 4b(W_A + C^R)E_S^R[(L^U - E_S^*)\bar{W}_S^U]}}{2b(W_A + C^R)}.$$

4.5.6 Conditions for interior solutions

As mentioned earlier, for the solution to the equilibrium condition for rural hukou holder (i.e., equation (28)) to lie in the interior, the parameters of the model should be restricted to take on certain values. For example, if the rural wage is so high that the expected payoff associated with working in agriculture is unambiguously larger than the expected payoff associated with migrating to the city, then the strategy of staying in rural sector will be dominant. This case will result in a corner solution in which no people will migrate to the urban area. In contrast, if the rural wage is low enough, staying in the rural sector will be dominated by the search strategy of migrating to the city. In this case, all people will choose to migrate to the city. In reality, we observe that some people are

migrating to the urban area, while some people stay in the rural area. That is, the solution must be interior.

This part will examine the conditions that guarantee the interior solutions. For rural hukou holders, if the strategy of staying in the rural area is dominant, no people will choose the strategy of migrating to the city. In this extreme case, the following conditions should be satisfied.

$$(39a) \quad E(DI_U^R) < E(DI_R^R).$$

$$(39b) \quad L_U^R = 0.$$

After substituting the expressions of the expected payoffs associated with two search strategies, we will get:

$$(39c) \quad W_A > W_S^R P_S^R + W_{NS}^R (1 - P_S^R) - C^R.$$

In this extreme case, since no workers with rural hukou migrate to the city, the probability of getting a job in the SOE sector for the marginal rural hukou holder would be equal to 1. That is, $P_S^R = 1$. Thus, (39c) implies:

$$(39d) \quad W_A > \bar{W}_S^R - C^R.$$

As can be seen, if the rural wage W_A is high enough, all workers with rural hukou will stay in the rural sector. In order to make the solution interior, the inequality above should be reversed. That is, one condition for the interior solution is:

$$(39e) \quad W_A < \bar{W}_S^R - C^R.$$

On the other hand, there should be a lower bound for W_A . If the agriculture wage is low enough, all people will migrate to the city, and the strategy of staying in the rural area would be dominated. In this case, $L_U^R = L^R$, and $P_S^R = \frac{E_S^R}{L^R}$. By equation (32), the market-clearing wage per efficiency unit of labor in the non-SOE sector would be $W_{NS}^* = \frac{A}{L^U + bL^R - E_S}$. Following the same procedure as above, we can obtain the lower bound below.

$$(39f) \quad W_A > \bar{W}_S^R \frac{E_S^R}{L^R} + b \frac{A}{L^U + bL^R - E_S} \left(1 - \frac{E_S^R}{L^R}\right) - C^R.$$

Again, E_S^R and E_S remain unchanged, such that $E_S^* = a - \frac{1}{2} \bar{W}_S^U$, and $E_S^{R*} =$

$\frac{b\bar{W}_S^U - \bar{W}_S^R}{2d}$. In summary, the conditions to assure that the solution to the equilibrium is

interior should be such that W_A lies in an open interval specified as follows:

$$(39g) \quad W_A \in (\bar{W}_S^R \frac{E_S^R}{L^R} + b \frac{A}{L^U + bL^R - E_S} (1 - \frac{E_S^R}{L^R}) - C^R, \bar{W}_S^R - C^R).$$

4.5.7 Numerical illustration

In order to gain more intuition on how this model fits the current Chinese labor market and how it can be utilized to analyze the Chinese labor market conditions, we will derive the equilibrium results in an illustrative example. This numerical example should be considered as suggestive of the approximate magnitude, and readers are invited to substitute their own parameter values.

In this hypothetical Chinese economy, the total labor force is 1000, in which 400 workers hold urban hukou and 600 hold rural hukou. This proportion accords quite well with the value observed in current China. The exogenously determined institutional wages in the SOE sector for workers with urban and rural hukou are 4,000 and 2,000, respectively. These wages are approximately equal to the true monthly respective wages in China. I further set the invariant agriculture wage is 900 and the cost of living in the city for rural migrants C^R is equal to 800. There are several other exogenous parameters

in the model, and they are assumed to take the values in Table 4.1.

Table 4.1 Hypothetical Values for Exogenous Parameters

Parameters	Values
d	20
a	2150
b	0.8
A	820000

Plugging these numbers above into our model, we can get the labor allocation in the SOE sector. The result is: $E_S=150$, $E_S^R=30$, and $E_S^U=126$. That is, 30 workers with rural hukou are working in the SOE sector, while 126 urban hukou holders are working in this sector. Given these values, we can solve for the whole equilibrium. By equation (38), we can solve for $L_U^R=187$. Substituting this value into equation (32), we get $W_{NS}^*=2053$, which is the market-clearing wage per efficiency unit of labor in the private sector. Since a rural hukou holder only has 0.8 efficiency unit of labor for the urban job, the wage per worker with rural hukou is equal to 1643 in the private sector. In addition, by market-clearing conditions in the non-SOE sector, we can get the labor allocation in the non-SOE sector. Furthermore, the endogenous probabilities of getting a job in the SOE sector for different hukou workers can also be derived. Table 4.2 and 4.3 display these

probabilities and demonstrate the full equilibrium results for urban and rural hukou holders in this hypothetical economy, respectively.

Table 4.2 Endogenous Probabilities in this Numerical Example

Probabilities	Values
P_S^U	0.315
P_S^R	0.160

Table 4.3 Equilibrium Results in the Hypothetical Chinese Economy

Urban Hukou			Rural Hukou		
Sector	Employment	Wage	Sector	Employment	Wage
SOE	126	4000	SOE	30	2000
Non-SOE	274	2053	Non-SOE	157	1643
Unemployed	0		Unemployed	0	
Agriculture	0		Agriculture	413	900
Total	400		Total	600	

As can be seen, among 600 rural hukou holders, 413 of them stay in the rural sector while only 187 workers migrate to the urban area. The magnitude of rural-to-urban migration is similar to what we observe empirically. Ren et al. (2008) said that nearly one

third of rural hukou holders are working in the urban areas.

Five results are reflected from this example. First, the labor market is segmented not only between rural and the urban area, but also within the urban area. Remember that we assume workers with each identical hukou are homogenous. However, the same worker with rural hukou could earn different wages in different sectors. For rural hukou holders with identical productivity, the SOE sector pays the highest wage (2000), followed by the non-SOE sector (1643), and the agriculture sector pays the lowest wage (900). Even for the urban hukou holders, the SOE sector pays higher wages than the non-SOE sector (4000 versus 2053). In addition, the better jobs are rationed, in that only a fraction of those who would like the high pay jobs in the SOE sector and are capable of performing them are hired into them. Thus, this illustrative example indicates the existence of the labor market segmentation.

Second, there exists observed wage differential for workers with different hukou, not only due to the differential in productivity measured by efficiency units of labor, but also because of the wage discrimination in the SOE sector. Without discrimination, if a worker with urban hukou earns 4000 in the SOE sector, a worker with rural hukou who has 0.8 efficiency unit of labor should have earned 3200 in this sector. However, the actual wage for a rural hukou holder is only 2000 in the SOE sector. This wage differential after adjusting for productivity differential simply mirrors the wage discrimination in

state-owned enterprises. There is no wage discrimination in the non-SOE sector, since the wage differential between two types of workers in this sector is solely attributed to difference in efficiency units of labor.

Third, there exists observed hiring differential in the SOE sector between workers with urban and rural hukou. The probability of being hired in the SOE sector is 0.315 for workers with urban hukou, which is larger than that probability for rural hukou holders, 0.160. Assume that each efficiency unit of labor is treated the same in the SOE sector, regardless of the person's hukou status. If the probability of being hired in the SOE sector for an urban hukou holder with 1 efficiency unit of labor is 0.315, then the probability for a rural hukou holder with 0.8 efficiency unit of labor should be equal to $0.8 \times 0.315 = 0.252$. However, the actual probability is 0.160, which is much lower than 0.252. Therefore, we can conclude that the hiring differential results not only from the inherent productivity differential, but also from the hiring discrimination in the SOE sector against rural hukou holders.

Fourth, the market-clearing wages in the non-SOE sector for workers with each hukou avoid unemployment in the urban labor market. All workers physically in the urban area who want a job in the non-SOE sector are able to find such a job. Thus, unlike the H-T model, open urban unemployment does not exist in this model.

Finally, the wage distribution of this hypothetical economy can be visualized by the wage density function and cumulative distribution function in the following two figures. There are five spikes in Figure 4.2, with the mode 900. Nearly a half of workers in this economy still earn lower than 1000. The average wage in this economy is only 1771.

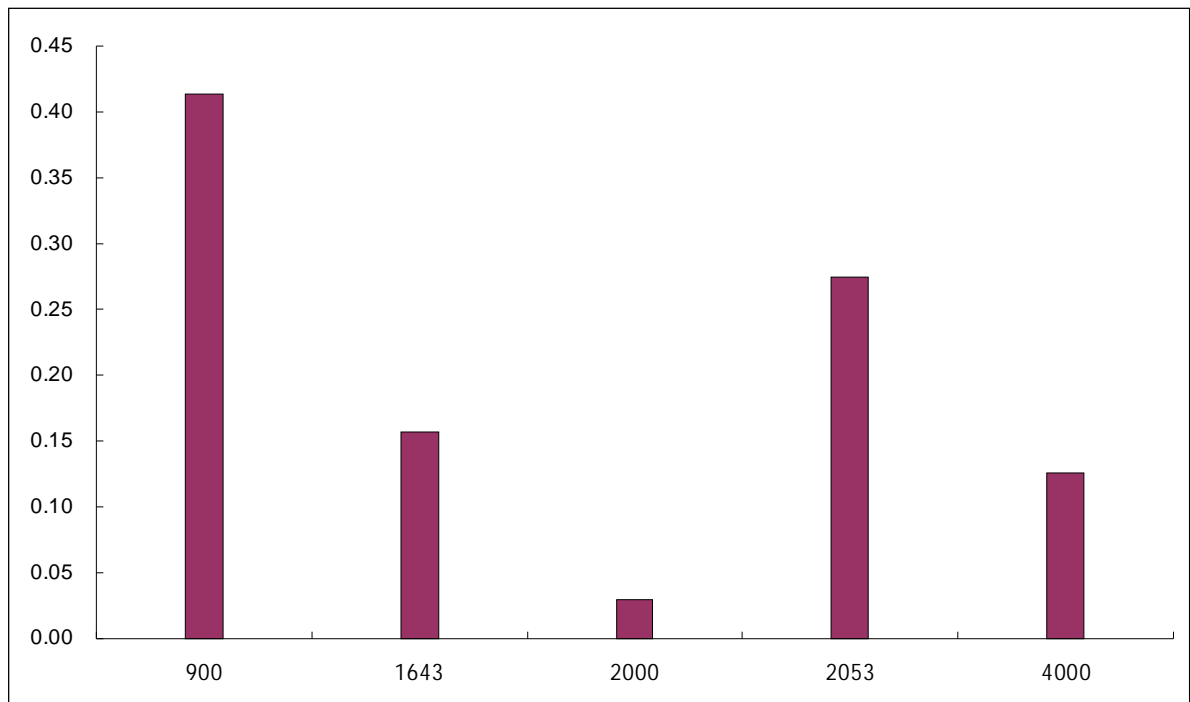


Figure 4.2 Wage Density Function

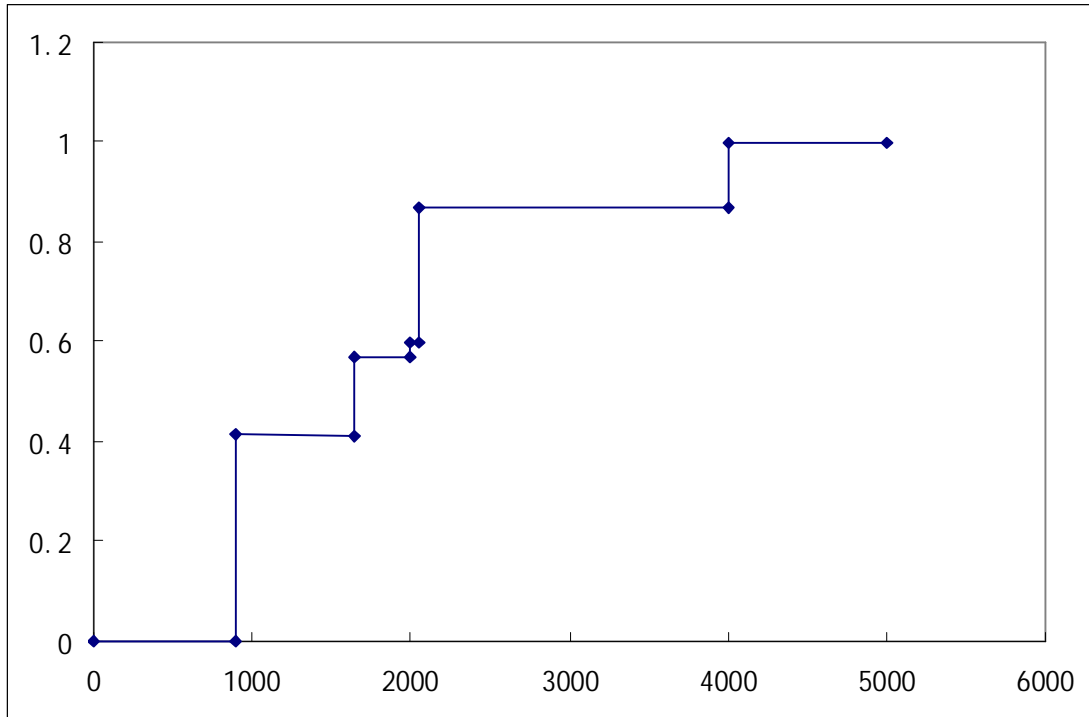


Figure 4.3 Cumulative Distribution Function of Wage (cdf)

Can wages truly reflect workers' standard of living in this context? The answer is no in this context, because workers with rural hukou earn higher wages in the city compared to those staying in the rural area, but also have to bear higher costs of living in the city. Then we examine the distribution of discretionary income which takes into account the cost of living in a given location. Table 4.4 displays the results using the illustrative example introduced above. Since C^R is assumed to be 800, compared to Table 4.3, the discretionary income of rural hukou holders should be the wage minus 800.

Table 4.4 Discretionary Income (DI) and Employment

Urban Hukou			Rural Hukou		
Sector	Employment	DI	Sector	Employment	DI
SOE	126	4000	SOE	30	1200
Non-SOE	274	2053	Non-SOE	157	843
Unemployed	0		Unemployed	0	
Agriculture	0		Agriculture	413	900
Total	400		Total	600	

As can be seen, the lowest discretionary income is not in rural area, but in the non-SOE sector for rural hukou holders. Furthermore, the discretionary income of rural hukou holders is unambiguously lower than that of urban hukou holders, no matter which sector or area they are working in. Figure 4.4 presents the distribution of discretionary income in this economy.

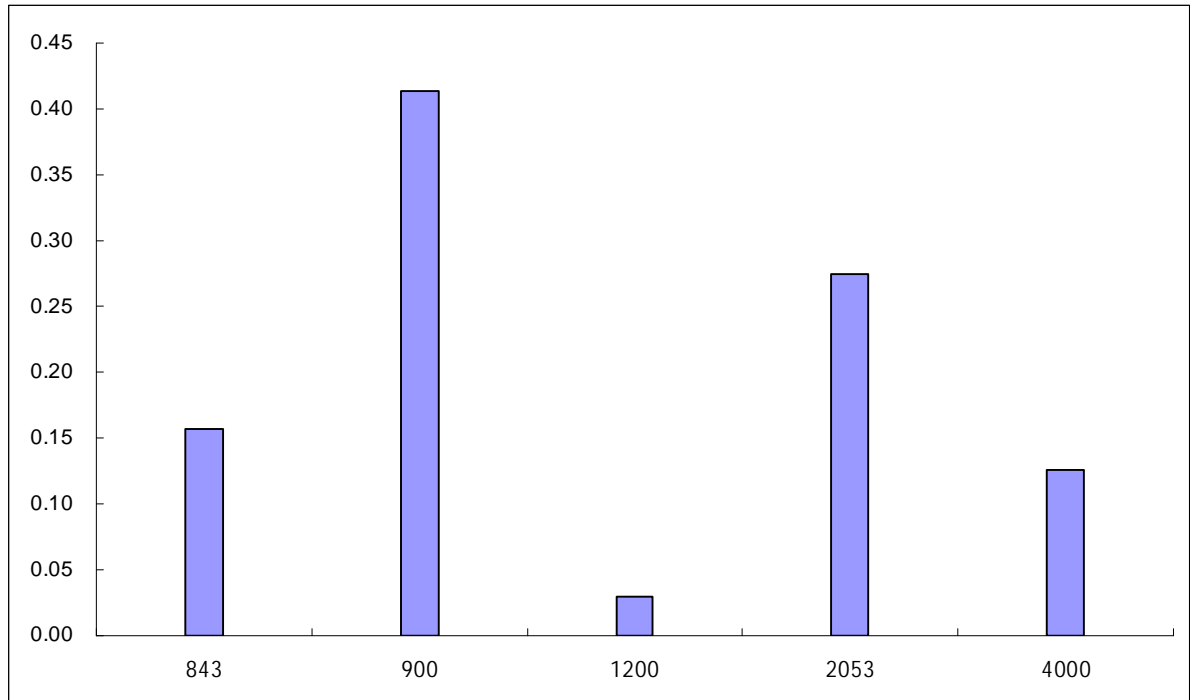


Figure 4.4 Distribution of Discretionary Income

The graph above indicates that there is a big gap in terms of discretionary income between urban and rural hukou holders. All workers with rural hukou are at the left end of the distribution, whereas all urban hukou holders are located at the right end of the distribution. The average discretionary income for rural and urban hukou holders are 900 and 2666, respectively. The ratio of discretionary income is around 3:1 for the two groups of workers. The analysis in terms of distribution of discretionary income above is a starting point, from which we will analyze in great detail the effects of a variety of labor market policies on the income distribution in the next chapter of the dissertation.

4.6 Conclusion

As Fields (2007) pointed out, good policy work requires sound theoretical foundations. In China's context, hitherto, very few studies have attempted to establish theoretical models for Chinese labor market. Many unique features of Chinese labor market have not been taken into adequate consideration.

Based on the central features of the current Chinese labor market, the present paper constructed a three-sector segmented labor market model including an urban SOE (state-owned enterprises) sector, an urban private sector, and a rural agricultural sector. These sectors' labor markets differ from one another in terms of the way each one operates, the way employment and wages are determined within each, how the several labor markets connect with one another, and how conditions in the various sector differ as between workers with urban and rural residential permits.

The system of residential permits, unique to China, has been called by its Chinese name hukou. The model presented in this paper shows that the hukou system affects the current Chinese labor market through two major channels. One is that the urban state-owned enterprises (SOEs) practice both hiring discrimination and wage discrimination against rural hukou holders. Another feature of the hukou system is that rural hukou holders have to bear a large cost when they live in the city, but they do not

have the same access to various government programs and public services as urban hukou holders. These two mechanisms together help explain a puzzle observed in current China: a considerable number of rural hukou holders still choose to stay in the poor rural area and earn very little, instead of migrating to urban areas where labor shortages are endemic and wages are many times higher.

Finally, the model developed in this chapter could serve as a solid foundation for helping us analyze income distribution of an economy from labor market perspective. According to the most recent Chinese official document, the most significant part of China's *12th Five-Year Plan* is the focus shift from allowing some people to get rich to creating a more even distribution of income. How can we achieve the goal to improve Chinese people's economic well-being? As Fields (2008) claimed, labor market condition is very much important for income distribution because most people, especially the poor, derive all or the great bulk of their income from the work they do. Labor income inequality accounts for more of total income inequality than do all other income sources combined (Fields, 2005). Therefore, it would be extremely useful and necessary to analyze the income distribution from labor market perspective. Without developing a theoretical model on the current Chinese labor market, we may not be able to evaluate how a proposed policy would affect the income distribution of the whole economy, since a policy implemented in one sector may generate unexpected outcome on another

economic sector. This paper exactly filled in this gap. The multi-sector model constructed in this chapter with the central features of the current Chinese labor market will enable us to analyze the effects of labor market policies on the whole income distribution. The model will help China make more sound labor market policies especially in terms of achieving distributive objectives.

Appendix:

Appendix 1: Proof of equation (29).

We claim that the discretionary income for urban hukou holders in the city is larger than in the rural area. That is, we need to prove:

$$(A1) \quad W_S^U P_S^U + W_{NS}^U (1 - P_S^U) > W_A.$$

By assumption, $W_S^U > W_A$ and $W_{NS}^U > W_A$, so the weighted average of W_S^U and W_{NS}^U must be larger than W_A as well.

Appendix 2: Derivations of equation (32)-(38).

By the market-clearing condition in the private sector, we have the following equation reflecting that the number of efficiency units demanded in the private sector is equal to the number of efficiency units supplied in this sector.

$$(A2) \quad E_{NS} = L_U^U + b L_U^R - E_S.$$

By substituting (A2) into equation (13), we get:

$$(A3) \quad W_{NS}^* = \frac{A}{L^U + bL_U^R - E_S}.$$

If we further substitute (A3) into equations (16) and (17), we prove equations (32) and (33). Then we derive the solution to L_U^R in the equilibrium. Substituting equations (23) and (33) into (31) and re-arranging, we obtain:

$$(A4) \quad W_A + C^R = (\bar{W}_S^R - b \frac{A}{L^U + bL_U^{R*} - E_S^*}) \frac{E_S^{R*}}{L_U^{R*}} + b \frac{A}{L^U + bL_U^{R*} - E_S^*}.$$

By multiplying $L_U^{R*} (L^U + bL_U^{R*} - E_S^*)$ on both sides and re-arranging, we have the following quadratic equation of one unknown variable L_U^{R*} .

$$(A5) \quad b(W_A + C^R)(L_U^{R*})^2 + [(W_A + C^R)(L^U - E_S^*) - bE_S^{R*}\bar{W}_S^R - bA](L_U^{R*}) - E_S^R[(L^U - E_S^*)\bar{W}_S^R - bA] = 0$$

Thus, we can solve for L_U^{R*} and obtain the expression in equation (38).¹⁰ The positive solution to L_U^R is given as follows.

Substituting equation (9) into (14) and re-arranging, we can get equation (34).

¹⁰ We found that another root is not a feasible solution. Specifically, it would make the number of rural hukou holders in the SOE sector become negative. Therefore, we have a unique as expressed in equation (38).

Similarly, we can obtain equation (35) by substituting equation (8) into (15) and re-arranging terms. In addition, we get equation (37) by substituting equations (8) and (9) into equation (6). Finally, because all workers in the agricultural sector are employed, we obtain equation (36) by substituting L_U^{R*} into equation (19) re-arranging terms. This completes the proof.

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Chapter 5 Effects of Labor Market Policies on Social Welfare: Application of a Theoretical Model for China¹¹

5.1 Introduction

This paper will conduct several policy experiments to examine how the changes in labor market policies could affect income distribution in China by utilizing a rigorously developed multi-sector model on the current Chinese labor market. Two alternative policy evaluation criteria will be adopted to investigate the distributive consequences of various labor market policies, including first-order welfare dominance approach and abbreviated social welfare function.

Very few previous studies have touched on this area. Ito (2008) employed a household-disaggregated, recursively dynamic computable general equilibrium (CGE) model and simulation techniques to uncover the effect of removing *hukou* system on Chinese income distribution. Ito's assumption is that Chinese labor market should be consistent with the original H-T model if the hukou system were removed. Accordingly, his study calculates the counter-factual labor allocation based on H-T model and compares this allocation with the actual observed situation, so as to simulate the effect of the removal of hukou system. The simulation results show that the removal of the hukou

¹¹ This chapter is co-authored with Professor Gary Fields.

system would be accompanied by a massive migration to cities. However, Ito's results are not convincing to me because I believe that even in the absence of the hukou system, the Chinese economy would not be in H-T equilibrium. As illustrated in Chapter 4, the original H-T model is not consistent with the observed labor shortage in coastal cities and the labor market segmentation between SOEs and non-SOEs. That is why we built a new theoretical model in Chapter 4 trying to better describe the current Chinese labor market.

Another study on the effect of the removal of *hukou* system showed that in the absence of hukou system, average per-capita income in urban and rural areas China would decrease and increase, respectively, further promoting rural-to-urban migration to a large extent (Whalley and Zhang, 2007). Both studies above employ a computable general equilibrium (CGE) framework and simulation analysis to model the counterfactual situation.

However, the modeling on the Chinese labor market in both papers is too rough to represent the complexity of segmented labor market in China. For instance, neither of the studies above takes into account of the labor market segmentation between state-owned enterprises and private firms. Furthermore, the policy evaluation criteria are not well defined. Most of previous studies either explicitly or implicitly use the magnitude of rural-to-urban migration as a policy evaluation criterion (Hertal and Zhai, 2006; Ito, 2008;

Bao *et al.*, 2009). These studies essentially hold the opinion that policies which will promote rural-to-urban migration are desirable and welfare-improving. We claim that this criterion is not appropriate because there is no economic or moral reason to simply judge whether the migration is good or not for people's economic welfare in a country. In contrast, this present paper will employ a rigorously developed theoretical model and well-defined welfare criteria to analyze the effects of labor market policies on income distribution. The unprecedented result of this chapter will give Chinese policy makers a crucial guidance about how to design labor market policy in order to improve social welfare.

In order to make sound and complete policy analysis, this paper will utilize the five step policy evaluation framework developed by Fields (2007a) to assess the effects of a variety of labor market policies. Specifically, the procedure is as follows.

**Policy instruments — Model — Outcomes — Policy evaluation criteria
— Policy evaluation judgment**

First, we clarify what exact policy experiments to perform. Using the theoretical model developed in Chapter 4, we propose to conduct the following policy experiments.

1. Rural development (RD). Specifically, this policy refers to an increase in agriculture wage.
2. Reduced Cost (RC). That is, the cost of living in cities for rural hukou holders will be reduced. (reduce C^R), while keep the cost of living for urban hukou holders constant.
3. Hukou Conversion (HC). This one-shot policy means that the government entitles a proportion of rural hukou holders working in the city with urban hukou (increase L^U).

The reason we select the policies above is that these three policies are the most discussed and relevant in China's labor policy agenda. Many government officials, economists, and policy analysts have made the policy recommendations as above. However, the welfare consequences of these policies have yet to be determined. This paper will fill in this gap and utilize the theoretical model on the Chinese labor market to investigate this policy question.

The second part of the framework is to specify the model. We will use the model developed in Chapter 4 as a solid foundation for the policy analysis. Once the policy instruments and the model have been specified, the third step is to use the model to predict the labor market outcomes. More specifically, we will re-solve the model for each

policy experiment and then compare the results in the new equilibrium with those in the original equilibrium.

In the fourth step, we will specify the policy evaluation criteria. As mentioned earlier, the present study attempts to examine how labor market policies could affect income distribution in China. Accordingly, the policy evaluation criteria should focus on some indicators or measures of income distribution. As Fields (2005) concluded, in the labor market analysis, it is not enough just to be concerned about distribution. How distributional concerns are brought into the policy analysis can and does make an important difference. The first welfare criterion I will use is the first order welfare dominance approach. The appeal of the dominance approach is that it relies upon ordinal measures of entire distributions and levels of welfare, while avoiding the use of index numbers that rest upon a dubious assumption of cardinality. As Saposnik(1981) claimed, the first-order dominance is the most straightforward approach to rank the income distributions. The criterion compares absolute incomes in ranked (ordered) positions in the income distribution and is thus also referred to as “rank dominance”. One distribution X first-order-dominates (FOD) another distribution Y for the class of anonymous, increasing social welfare functions if and only if the income of the person in each rank in X is at least as great as the income of the person with the corresponding rank in Y and

strictly greater someplace.¹² If the two distributions cross with each other, then these two income distributions cannot be ordered using the first-order dominance. We will use discretionary income (DI) as the measure of income for this approach, which is defined as the labor income minus the living cost in a given location. In other words, discretionary income is the realization of the expected payoff for a job searcher.

In addition, following the approaches employed by Fields (2005), we will complete the welfare economic analysis by utilizing an alternative measure for social welfare, namely abbreviated social welfare function in which the goodness of income distribution depends positively on total income, and negatively on income inequality and poverty. Again, the income here refers to discretionary income defined as in last paragraph. Eventually, for each policy instrument, the overall judgment will be made in the fifth step based on the specified policy evaluation criteria. We will conduct policy experiment analytically, rather than use calibrations to simulate the results, because the accuracy of calibrations may depend on whether the assumed function forms are valid.

The remainder of this chapter is organized as follows. Section 2 compares the income distributions with and without each proposed policy using the first-order welfare dominance as the policy evaluation criterion. We will examine whether the distribution of

¹² “Anonymous” means that all workers are treated identically regardless of which particular ones earn how much income. “Increasing” means that social welfare increases whenever one worker’s earnings increase, holding other workers’ earnings the same.

discretionary income under each policy first-order dominates the original distribution. Section 3 presents an alternative labor market analysis using an abbreviated social welfare function in which an increase in total income is regarded as welfare-improving, while an increase in income inequality or poverty is regarded as welfare-decreasing. The policy analyses in Section 2 and 3 will only focus on the benefits of each policy. That is, for now, the costs of different policies are ignored. As we know, from policy point of view, if the government is to choose between different policies, it needs to consider not only the consequences of implementing the policies, but also the costs of putting the policies into effect. Therefore, Section 4 will complete this social cost-benefit analysis by using the public finance framework, in which the government has a fixed budget, say B dollars, and then determines which policy to implement using this fixed budget. Section 5 concludes the paper and provides policy recommendations.

5.2 First-order dominance (FOD) approach

The first-order dominance method will be used to make welfare comparisons between the initial equilibrium and the new equilibrium that would result from each policy change. We will use the quantile function to conduct the first-order-welfare-dominance comparison, in which the discretionary income is a function of quantile of labor in the economy. According to the quantile functions, the

first-order-welfare-dominance criterion should be described as follows: One distribution X first-order-welfare-dominates another distribution Y if and only if the quantile function for X is above or equal to the quantile function for Y for all quantiles and strictly above someplace. For analytical convenience, from now on, we normalize the total labor force equal to 1. Our task is to figure out how many people earn each amount of discretionary income, and compare the two sets of numbers to see whether one set of income distribution lies above the other one. This method of showing income distributions is essentially equivalent to comparing the cumulative distribution functions (cdf), because the quantile function is the inverse function of the cdf. In the initial equilibrium, there are five possible values of discretionary income, which are listed in Table 5.1. In this table, the group is ordered by the amount of discretionary income from the lowest to the highest. Column 2 explains what type of workers each group refers to, and column 3 shows the five possible values of discretionary income. The last column of Table 5.1 stands for the number of workers earning the corresponding amount of the discretionary income in column 3.

Table 5.1 The Initial Distribution of Discretionary Income (DI)

Group	Group Description	DI (lowest to highest)	Number of people earning each DI
1	Rural hukou holders working in the private sector	$W_{NS}^R - C^R$	E_{NS}^R
2	Rural hukou holders working in agriculture sector	W_A	E_R^R
3	Rural hukou holders working in the SOE sector	$W_S^R - C^R$	E_S^R
4	Urban hukou holders working in the private sector	W_{NS}^U	E_{NS}^U
5	Urban hukou holders working in the SOE sector	W_S^U	E_S^U

Note: “NS” sector denotes the private sector (non-state-owned enterprises), while “S” sector denotes the state-owned enterprises. The superscript denotes the hukou type, and the subscript refers to the economic sector.

The ordering for the first three rows comes from the interior equilibrium condition for rural hukou holders. We know that the discretionary income (DI) for group 2 is a weighted average of the discretionary income for group 1 and 3, so this number must lie between the DI for group 1 and 3. Furthermore, since we know that the SOE sector pays a higher wage than the private sector, i.e., $W_S^R > W_{NS}^R$, it follows that DI for group 3 is larger than for group 1. Since the urban hukou holders don't have to bear the living cost C^R , their discretionary incomes are equal to the respective wages. By assumption in the model, workers with urban hukou in the SOE sector enjoy the highest DI, W_S^U .

Hitherto, only one ranking of DI has not been determined, group 3 versus 4, that is, the discretionary income for rural hukou holders working in the SOE sector ($W_S^R - C^R$) versus the DI for urban hukou holders working in the NS sector W_{NS}^U . The model so far cannot determine which of the two values is larger than another. I need to rely on the empirical evidence to see which one is larger. From chapter 3, we know from the RUMIC (Rural-Urban Migration in China) data set that the average monthly wage in the non-SOE sector for urban hukou holders is 2,018, while the average wage for rural hukou holders in the SOE sector is 1,530. Thus, we can infer that W_{NS}^U is larger than W_S^R . As a result, the difference between W_S^R and C^R should be definitely smaller than W_{NS}^U , given the fact that the cost of living for rural hukou holders in the city (C^R) is also substantial. As Ren *et al.* (2008) said, on average, the school fees per child in the city nearly account for one third of a rural migrant's annual income. Thus, it is safe to assume that $W_S^R - C^R$ is less than W_{NS}^U .

The income distribution described above is visualized as the step function in Figure 5.1. The horizontal axis denotes quantile of labor and the vertical axis denotes the discretionary income for each quantile. Again, the total labor force is normalized to be 1. The values in the graph below are exactly the same as presented in Table 5.1.

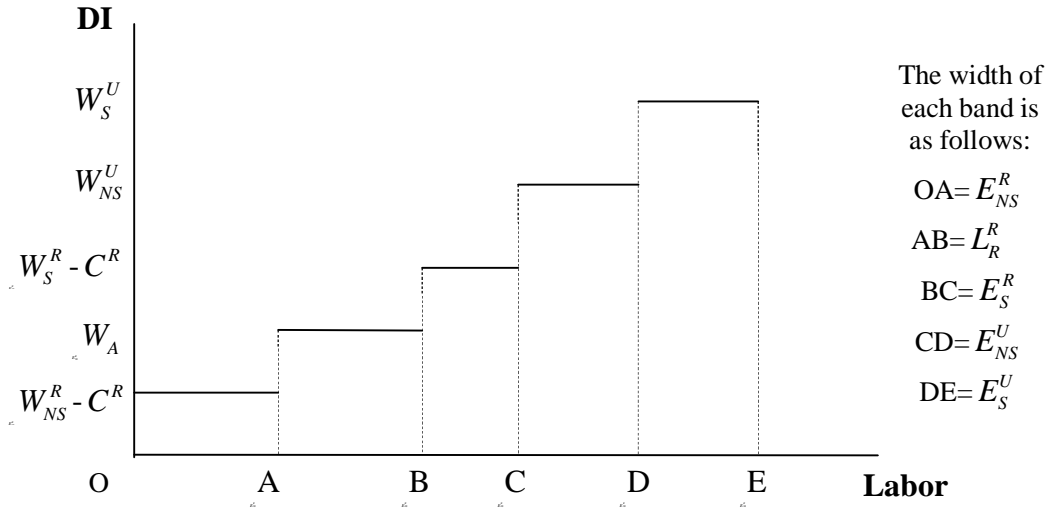


Figure 5.1 Initial Quantile Distribution of Discretionary Income (DI)

The balance of this section presents the results of the three policy interventions using the first-order dominance criterion described above. The proofs of the results are shown in the appendix.

5.2.1 Rural development (RD): FOD comparison

This section analyzes whether rural development strategy would improve the income distribution using the first-order dominance as the evaluation criterion. Since 2003, the Chinese government has implemented many public policies to promote rural development, including the abolition of agricultural taxes, the provision of subsidies for purchasing agricultural machines or equipment, the accelerated development of rural public services, increased investment in rural infrastructure and the provision of small

loans to rural households (Ash, 2010). Therefore, it is very important and necessary to determine whether rural development could improve the social welfare in China with a segmented labor market.

For simplicity, we consider the rural development as an increase in the agriculture wage for the policy analysis below. There might be different channels to increase the agriculture wage, such as providing financial loans to rural households, or offering workers with subsidies for better technology. However, the question about which specific channel is better than another is beyond the scope of our study. According to the five-step policy evaluation framework (Fields, 2007a), the policy instrument analyzed in this section is an increase in the agriculture wage, W_A . We assume that the increase in W_A is not large enough to alter the ranking of the discretionary income listed in Table 5.1. This assumption will also be maintained for the other policy analyses in the subsequent sections.

The effects of the rural development policy on discretionary income and employment levels are summarized in Table 2.

Table 5.2 The Effect of Rural Development Policy

Group	Group Description	Employment	Wages	DI
1	Rural hukou holders working in the private sector	-	+	+
2	Rural hukou holders working in agriculture sector	+	+	+
3	Rural hukou holders working in the SOE sector	0	0	0
4	Urban hukou holders working in the private sector	0	+	+
5	Urban hukou holders working in the SOE sector	0	0	0

Note: “+” denotes an increase in a particular variable, “-” denotes a decrease, and “0” stands for no change.

Let us explain the economic intuition behind the results above. As the agricultural wage increases, more rural hukou holders would choose to work in the agricultural sector, and therefore fewer people would migrate to the urban area. Since the employment level in the SOE sector for rural hukou holders is independent of the agricultural wage, it remains unchanged. Accordingly, we see more agricultural employment but less employment for rural hukou holders in the private sector.

In addition, the fall in rural-to-urban migration reduces the labor supply to the urban private sector, resulting in a higher market-clearing wage there. This is why the wages would increase in the private sector for both urban and rural hukou holders. Furthermore,

the discretionary income moves in the same direction as wages for all groups since there is no change on the cost of living for rural hukou holders in the city. Thus, in Table 5.2, we observe an increase in discretionary income for three groups: rural hukou holders working in agriculture, rural hukou holders working in the urban private sector, and urban hukou holders working in the private sector.

Given the results in Table 5.2, we can draw the distribution of discretionary income under the rural development (RD) policy and compare it with the original distribution. Figure 5.2 depicts the effects of the rural development policy on employment levels and discretionary income for each of the five groups. The solid step function OABCDE stands for the original distribution of discretionary income without the policy. The new income distribution generated by the rural development policy is displayed by dashed lines OA'B'C'D'E'. Comparing the two distributions, they coincide in ranges BC and DE, and the new distribution lies above the original one in all other ranges. As a result, the new distribution under rural development first-order dominates the original one. Therefore, we conclude that rural development is welfare-improving by the first-order welfare dominance criterion.

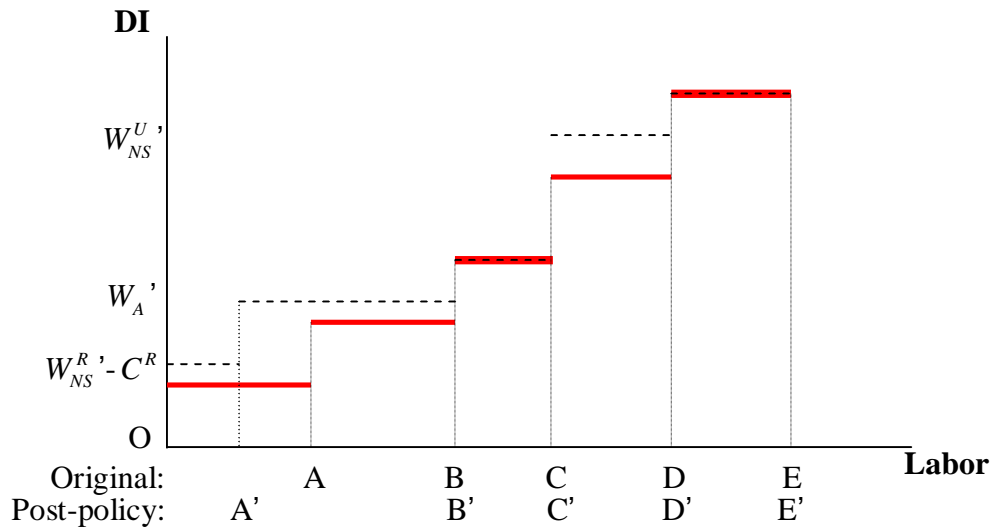


Figure 5.2 Quantile Distribution under Rural Development

5.2.2 Reduced cost (RC): FOD comparison

As introduced in the previous chapter, there is a large difference in the costs and benefits associated with living in the city between rural and urban hukou holders. Migrant workers with rural hukou have to pay extra fees for their children education in the city. Compared to urban residents, some rural hukou holders do not have access to medical insurance or assistance programs and thus need to spend much money on medical treatment once they develop some disease. In addition, most of workers with rural hukou do not have access to need-based welfare programs in the city, such as housing allowance, minimum living guarantee, etc.

This section will examine what would happen to the income distribution if the cost of

living for rural hukou holders in urban areas were reduced, while keep the cost of living for urban hukou holders constant. That is, the policy instrument analyzed in this section is a decrease in C^R . In practice, this could be done by lowering the schools fees for migrants' children education, or providing housing allowance for the rural migrants working in urban areas. Almost all of the previous studies claim that reducing the living cost for rural hukou holders is a desirable policy because it will promote migration. As mentioned previously, in my view, this criterion is not appropriate. It has yet to be determined whether reducing C^R would improve social welfare. In similar fashion, we will gauge the welfare effects of this policy experiment by the first-order dominance approach. Table 5.3 presents the results of such a reduced cost policy.

Table 5.3 The Effect of Reduced Cost Policy

Group	Group Description	Employment	Wages	DI
1	Rural hukou holders working in the private sector	+	-	+
2	Rural hukou holders working in agriculture sector	-	0	0
3	Rural hukou holders working in the SOE sector	0	0	+
4	Urban hukou holders working in the private sector	0	-	-
5	Urban hukou holders working in the SOE sector	0	0	0

Note: “+” denotes an increase in a particular variable, “-” denotes a decrease, and “0” stands for no change.

As the cost-of-living for rural hukou holders in the city decreases, more rural hukou holders would migrate to the city, while fewer people would remain in the rural area and work in the agriculture sector. Since the employment level in the SOE sector for rural hukou holders remains unchanged, the increased labor force in the urban area with rural hukou would enter the private sector. Hence, we see less agricultural employment but more employment for rural hukou holders in the urban private sector.

The reduced cost policy would increase the discretionary income for rural hukou holders in urban areas, whether they are working in the SOE sector or the private sector. However, because of the increased labor supply to the urban private sector, the wages for urban hukou holders in the urban private sector would decrease, so their discretionary income would fall. These effects are summarized in Table 5.3.

Figure 5.3 shows the distributions of discretionary income before and after the reduced cost policy. Again, the solid step function corresponds to the original income distribution, and the dashed lines represent the new distribution which would result from the policy of reducing C^R . As can be seen: (1) Workers in segments OA and BC are better off under the policy, (2) Workers in segments A'B' and DE experience no change in discretionary income; and (3) Workers in segments AA' and CD become worse off after the policy experiment. In this way, we can conclude that a policy of reduced cost for

urban hukou holders in urban areas neither welfare-dominates the original distribution nor is welfare-dominated by it. That is, we cannot make an unambiguous policy evaluation judgment solely based on the first-order dominance criterion.

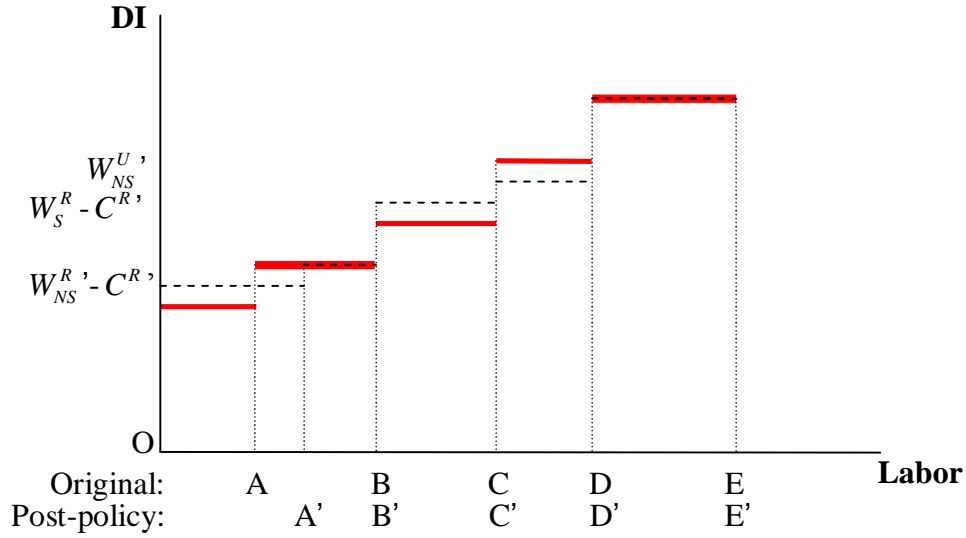


Figure 5.3 Quantile Distribution under Reduced Cost

5.2.3 Hukou conversion: FOD comparison

This policy experiment refers to changing a proportion of rural hukou holders' hukou status from rural to urban hukou. Specifically, the policy instrument analyzed in this section is an incremental increase in L^U . We conceive of the timing of the policy experiment as follows. At the original equilibrium, the government randomly selects a small percentage of rural hukou holders who are working in the city and immediately

grants them urban hukou. After the hukou conversion, workers and firms will re-optimize and reach a new equilibrium. The effects of such a hukou conversion policy are shown in Table 5.4.

Table 5.4 The Effect of Hukou Conversion Policy

Group	Group Description	Employment	Wages	DI
1	Rural hukou holders working in the private sector	-	-	-
2	Rural hukou holders working in agriculture sector	-	0	0
3	Rural hukou holders working in the SOE sector	0	0	0
4	Urban hukou holders working in the private sector	+	-	-
5	Urban hukou holders working in the SOE sector	0	0	0

Note: “+” denotes an increase in a particular variable, “-” denotes a decrease, and “0” stands for no change.

Due to the hukou conversion policy, people whose hukou types get converted would be better off and earn higher discretionary income. However, the hukou conversion policy would increase the supply of labor to the urban private sector, causing the wage there to fall. This results in a decrease in the discretionary income for people in the private sector with either hukou type.

Given the results above, we draw the distribution of discretionary income under the

hukou conversion policy, which is shown in Figure 5.4.

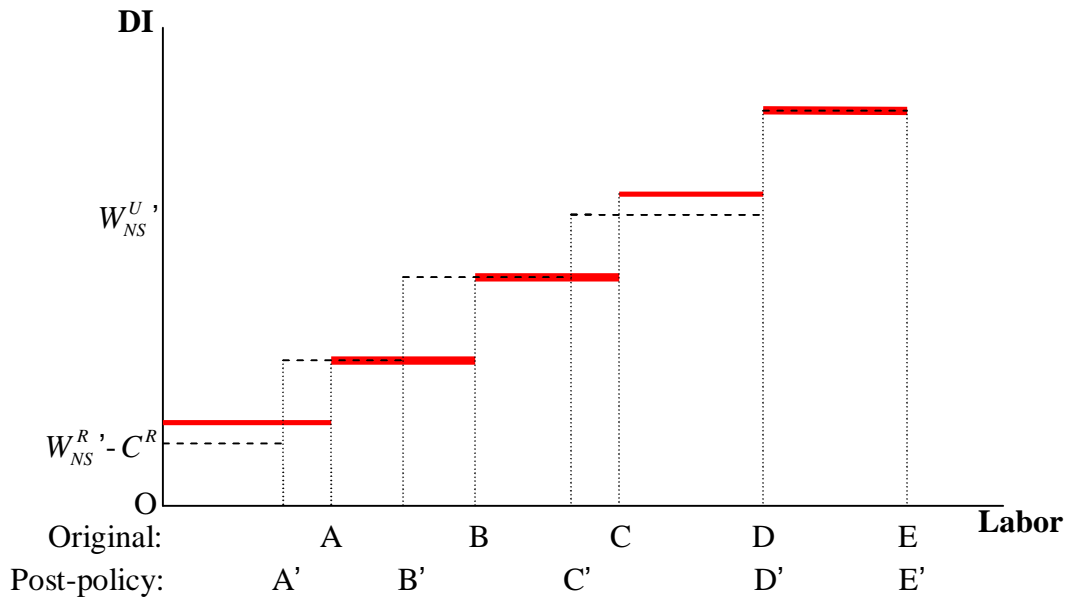


Figure 5.4 Quantile Distribution under Hukou Conversion

Compared to the original income distribution, workers in segments AA', B'B, and C'C become better off. However, workers in segments OA' and CD become worse off. Other segments remain unchanged. As a consequence, the post-policy distribution neither first-order welfare dominates the original one nor is dominated by it.

In summary, only the rural development policy yields an unambiguously welfare-improving income distribution using the first-order welfare dominance criterion.

In contrast, the reduced cost and hukou conversion policies have ambiguous effects on social welfare using the first-order dominance criterion. Finally, no proposed policy among the three alternatives is unambiguously welfare-decreasing using this welfare criterion.

5.3 Abbreviated social welfare function

As an alternative way to evaluate social welfare, abbreviated social welfare function approach was initially created by Lambert (1993) and employed by Fields (2005) in the context of the simplified Harris-Todaro model. In the analysis below, we work with a class of abbreviated social welfare functions of the form:

$$(1) \quad SW = f(\text{Total income, poverty, income inequality}), \quad f_1 > 0, \quad f_2 < 0, \quad f_3 < 0.$$

Again, “income” in this context refers to the discretionary income defined as previously. In this abbreviated social welfare function, economic well-being depends positively on the total income earned by all workers, negatively on poverty, and negatively on income inequality. Since there are five values of income throughout this economy, the total income of all workers is the sum of discretionary income earned by each group. The income of each group is the product of income per worker times the

number of workers in each group.

The second component in the specified welfare function is poverty. Specifically, poverty is measured here by the poverty headcount or poverty headcount ratio. Because the total population is constant, the results of the analysis based on the two measures are the same. Hence, we measure poverty by the poverty headcount defined as the number of workers whose discretionary incomes are below or equal to a given poverty line. As we know, most agriculture workers in China still earn very little and have low standard of living. Hence, a reasonable place to set the poverty line in the model is the agricultural wage in the original equilibrium, that is, W_A . We set the poverty line $z = W_A$.¹³ Accordingly, there are two groups of workers in poverty, including agricultural workers in rural China and workers with rural hukou working in the urban private sector.

In terms of measuring income inequality, we use the difference in average discretionary income between workers living in the urban and rural area as the measure of inequality. One of the biggest policy concerns on inequality in current China is urban-rural inequality, that is, the income gap between urban and rural dwellers.¹⁴ The average income for rural dwellers is equal to W_A , since all workers in the rural area earn

¹³ If the poverty line is set at the new agriculture wage after the rural development policy, then the rural development policy would not reduce poverty using the poverty headcount measure, but would reduce the depth of poverty. This would require us to use more complicated poverty measures such as P_2 . For reasons of mathematical tractability and to be able to use the poverty headcount measure, we set the poverty line equal to the original agriculture wage before any policy change.

¹⁴ To ease the calculations, we found it easier to use the difference in discretionary income of urban workers compared to rural workers rather than the ratio.

this amount. The average income for people living in the urban area is a weighted average of four groups of workers in the city.

For each policy among the three alternatives, we derived each of the arguments of the abbreviated social welfare function. The results are summarized in Table 5.5, and the proofs are provided in Appendix 5.

**Table 5.5 Summary of Welfare Analysis of Three Policies Using
Abbreviated Social Welfare Function**

Labor market policy	Change in total income	Change in poverty headcount	Change in income inequality	Change in welfare
Rural Development	+	-	-	+
Reduced Cost	-	0	-	ambiguous
Hukou Conversion	ambiguous	-	ambiguous	ambiguous

Note: “+” denotes an increase in a particular variable, “-” denotes a decrease, and “0” stands for no change.

As can be seen, only RD policy is unambiguously welfare-improving, in that it increases total income, reduces income inequality, and also reduces poverty. The RC

policy does reduce inequality, but it would also make the total income fall, rendering the welfare-ambiguous consequence. The HC policy also generates a welfare-ambiguous result in that it has ambiguous effects on total income and income inequality, and depends on parameters values.

The welfare economic results from Sections 2 and 3 for the first-order-dominance approach and the abbreviated social welfare function are summarized in columns 2 and 3, respectively, of Table 5.6.

Table 5.6 Summary of Welfare Economic Analysis of Three Policies

Labor market policy	Change in social welfare using first-order dominance	Change in social welfare using abbreviated social welfare function
Rural Development	+	+
Reduced Cost	ambiguous	ambiguous
Hukou Conversion	ambiguous	ambiguous

According to the results presented above, rural development policy would generate a better income distribution no matter which of the two welfare evaluation criteria we use.

However, it is worth pointing out that we can *not* say from the preceding analysis that the RD policy is Pareto-improving. The reason is that the Pareto criterion requires that we look at welfare changes for each identified person in the economy and the analysis here has no way of identifying which people are which.

Another conclusion drawn from Table 5.6 is that none of the proposed policy is welfare-decreasing. The income distributions generated by RC and HC policies neither first-order dominate the original one nor dominated by it, implying that for each policy, some groups become better off while some others become worse off. Furthermore, the effects of RC and HC on social welfare are also ambiguous when we use the abbreviated social welfare function, which depends positively on total income, and negatively on income inequality and poverty. This partly explains the policy debate in current China that some people favor the RC and HC policy while some do not.

5.4 Social cost-benefit analysis of labor market policies

As mentioned previously, the policy analyses in Section 2 and 3 only focused on the benefit side of each policy but ignored the costs of implementing different policies. From the policy point of view, if the government is to choose between different policies, it needs to consider not only the consequences of implementing the policies, but also the

costs of putting the policies into effect. In order to assess the returns from public expenditures, economists have long relied on social cost-benefit analysis (Fields, 2007a). Section 5.4 will complete the social cost-benefit analysis by using a public finance framework, in which the government has a fixed budget, say B dollars, and then determines which policy to implement using this fixed budget. Keeping the cost side constant for each policy, we will again examine the benefit side by the first-order dominance approach.

5.4.1 Social cost-benefit analysis

As Fields (2007a) claimed, the social cost-benefit criterion may be stated as follows: a project is socially profitable if the total social benefits exceed the total social costs. The larger the difference between total social benefits and total social costs, the more worthwhile the project. We begin the social cost-benefit analysis by imagining that the government has a fixed budget, say B dollars. How should it be spent? The answer depends on the precise objective. Since the aim of this paper is to examine the effects of labor market policies on income distribution in China, I will adopt the first-order welfare dominance criterion to measure the benefit of each policy, which takes into account the distributional aspects. Specifically, I will compare three hypothetical income distributions which results from the three respective policies using the fixed amount of budget. In order to make the discussion clearer, I will employ the first-order dominance approach for

each pair comparison. More concretely, we denote the income distribution resulted from RD policy using B dollars as Y_1 . Similarly, let Y_2 and Y_3 stand for the income distributions generated by RC and HC policies, respectively, each of which use the same amount of budget, i.e., B dollars. Then our task is to compare Y_1 versus Y_2 , Y_1 versus Y_3 , and Y_2 versus Y_3 by the first order dominance criterion. Given the fixed cost of each policy, the budget should be spent on the policy whichever generates the income distribution that first-order dominates the other two income distributions according to the social cost-benefit criterion.

5.4.2 Cost of each policy

For the purpose of conducting sound social cost-benefit analysis, I need to explain very carefully how the cost of each policy occurred, that is, who is undertaking which action. In previous sections of this paper, when stating that the government implements different labor market policies, we have not specified which particular government we referred to. Since the purpose of labor market policies analyzed in this paper is to create a better income distribution in China, it is the central government that should play a role in improving nation-wide income distribution. Thus, in the subsequent sections, we assume that the central government has a budget of B dollars and makes a decision about which labor market policy to implement among the three alternative policies, namely, RD, RC,

and HC.¹⁵ The three sub-sections below describe how the cost is occurred and paid for each of the three policies above.

5.4.2.1 Cost of rural development policy

The rural development policy involves an increase in the agriculture wage. In the past few years, the central government of China has been implementing a variety of public policies to promote rural development, including the abolition of agricultural taxes, the provision of subsidies for purchasing agricultural machines or equipment and subsidies for planting certain kinds of agriculture products, the accelerated development of rural public services, increased investment in rural infrastructure and the provision of small loans to rural households (Ash, 2010). There might be different channels to increase the agricultural wage, such as providing financial loans to rural households, or offering workers subsidies for better technology. Given the fixed fiscal transfers to agricultural workers, these channels may produce different multiplier effects in terms of increasing rural income. However, as mentioned previously, the question about which specific channel is better than another is beyond the scope of our study. What we know is that one dollar budget allocated to an agriculture worker could generate at least one dollar of income increase. Denote this multiplier as M , meaning that one dollar budget allocated

¹⁵ For analytical convenience, we do not consider how this budget is collected or financed. For example, the budget can come from an endowment from a development bank.

to an agriculture worker could generate M dollar income increase ($M \geq 1$)¹⁶.

Given this assumption, let us denote $L_{R, RD}^R$ as the number of rural hukou holders working in the rural sector after the rural development policy. Accordingly, each person in $L_{R, RD}^R$ would enjoy a wage increase from W_A to W_A' . Given the fixed budget of B dollars from central government, we have the following governmental budget constraint for the rural development (RD) policy.

$$(2a) \quad \frac{B}{L_{R, RD}^R} M = \Delta W_A, \text{ where } \Delta W_A = W_A' - W_A.$$

Equivalently, by manipulating the formula above, we have:

$$(2b) \quad W_A' = W_A + \frac{MB}{L^R - L_{U, RD}^R}.$$

5.4.2.2 Cost of the reduced cost policy

The reduced cost policy refers to a reduction in C^R . As is known, the local government in cities charges rural *hukou* holders substantial sums for housing, health care, and education and deny them unemployment benefits and other need-based welfare

¹⁶ In fact, it may be possible that $M < 1$ because of the cost of funds such as administrative cost of allocating funds or corruption. However, the results shown below are still valid even though M is less than 1. That is, the only necessary assumption we make here is that $M > 0$.

benefits. Recalling the model setup in chapter 4, the economy has a single rural area in inland (central and western) region and a single urban area in coastal (eastern) region of China. Accordingly, the local government in the urban area originally charged C^R through public schools, public hospitals, and so on. Let us specify the cost of RC policy as follows. The central government pays the cost of living for rural migrants to local government in the destination urban area. Denote $L_{R,RC}^U$ as the new number of urban hukou holders migrating to the city after the RC policy. Due to the policy change, each person in $L_{R,RC}^U$ would face a new cost of living $C^{R'}$. That is, each rural hukou holder in the city after the reduced cost policy would enjoy the lower cost, and there are $L_{R,RC}^U$ of them. The central government uses the fixed budget to pay for these reduced cost, which is equal to $L_{R,RC}^U$ times the amount of reduced cost for each worker with rural hukou. Given the fixed budget of B dollars from central government, we have the following governmental budget constraint for RC policy.

$$(3a) \quad B = |\Delta C^R| L_{R,RC}^U, \text{ where } |\Delta C^R| = |C^{R'} - C^R| = C^R - C^{R'}.$$

Since C^R is reduced in the RC policy, the absolute value of the change in C^R is equal to C^R minus $C^{R'}$. An equivalent expression of the condition above is as follows:

$$(3b) \quad C^{R'} = C^R - \frac{B}{L_{R,RC}^U}.$$

5.4.2.3 Cost of hukou conversion policy

This policy experiment refers to changing a proportion of rural hukou holders' hukou status to urban hukou, that is, an increase in L^U . Recall the timing of this policy illustrated previously. At the original equilibrium, the government randomly selects a percentage of rural hukou holders who are working in the city and immediately entitles them with urban hukou. Before the policy change, these selected people need to pay the cost of living (C^R) to the local government. However, after the policy change, they no longer need to pay this cost. The central government uses the fixed budget to pay the cost of living for those who convert their hukou status from rural to urban to local government in the destination urban area. Therefore, the budget constraint of central government is indicated below for the HC policy.

$$(4a) \quad B = (\Delta L^U) C^R, \text{ where } (\Delta L^U) = L^{U'} - L^U. \text{ Equivalently,}$$

$$(4b) \quad L^{U'} = L^U + \frac{B}{C^R}$$

Then we could compare the income distributions generated by the three respective policies using the same amount of budget, that is, B dollars. Let Y_1 , Y_2 and Y_3 denote the income distributions resulted from rural development (RD), reduced cost (RC) and hukou conversion (HC) policies, respectively, each of which use the same amount of budget, i.e., B dollars. Given the fixed cost of each policy, the budget should be spent on the policy whichever generates the income distribution that first-order dominates the other two

income distributions according to the social cost-benefit criterion. Moreover, for simplicity, we maintain a previous assumption that B is not large enough to alter the order of the discretionary income listed in Table 5.1 for any of the three policies.

5.4.3 Pairwise policy comparison with a fixed budget using FOD

This section will analyze three income distributions generated by the three policies with a fixed budget by the first order dominance (FOD) criterion. To make the discussions and graphs clearer, we divide the whole discussion into three pair comparisons, including Y_1 versus Y_2 , Y_1 versus Y_3 , and Y_2 versus Y_3 , respectively. Furthermore, from now on, Y_1 and Y_2 will be displayed using the long and short dashed lines, respectively, and Y_3 will be represented by dotted lines throughout the remainder of this paper.

5.4.3.1 Comparison of rural development and reduced cost

Owing to the assumption that B is not large enough to alter the order of the discretionary income listed in Table 5.1 for any of the three policies, we can make use of the results from Section 2 to draw the graph of quantile distributions generated by RD and RC policies, respectively. These graphs give us considerable information about the relative position of each of five segments in the quantile distributions resulted from RD

and RC policies. From now on, we denote the five segments in all of the previous figures as Segment 1, 2, 3, 4, and 5 (from the left to the right). Accordingly, based on the results shown in Figure 5.2 and 5.3, Segment 5 is the same for both Y_1 and Y_2 , including the length (horizontal) and position (vertical). In Segment 4, Y_1 lies above the original distribution, whereas Y_2 lies below the original distribution. Thus, Y_1 should lie above Y_2 in Segment 4. Using the same logic, we conclude that Y_2 lies above Y_1 in Segment 3, but below Y_1 in Segment 2. Furthermore, Y_1 is longer in Segment 2 but shorter in Segment 1 than Y_2 . However, it is not easy to see which distribution is higher in Segment 1, because both the RD and RC policies increase the discretionary income of rural hukou holders working in the private sector in the urban area, and we do not know yet which policy would generate a relatively larger increase. In fact, the answer would depend on the extent of income increase resulted from one dollar budget allocated an agriculture worker under the rural development policy.

Case 1: Multiplier effect (M) of rural development policy is sufficiently small. That is, one dollar budget allocated to an agriculture worker could generate a small income increase.

We know that $M \geq 1$. Thus, we can examine the extreme case in which $M=1$. In Appendix 5a, I show that if $M=1$, Y_2 would be indeed higher than Y_1 in Segment 1 using

the budget constraints specified in equations (2a) and (3a) and approximation technique. That is, the discretionary income of rural hukou holders working in the non-SOE sector would be larger under reduced cost policy than rural development policy with the same amount of budget. In this case, we obtain the following graph showing the two quantile distributions resulted from RD and RC policies, respectively.

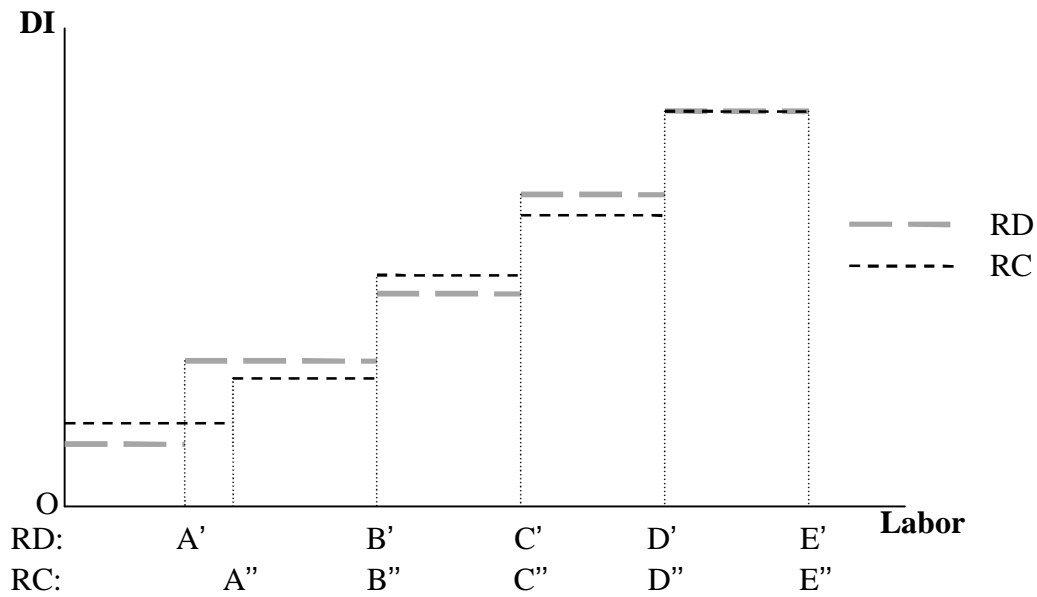


Figure 5.5a Comparison of Income Distributions under Rural Development (RD) and Reduced Cost (RC) (M is small)

In Figure 5.5a, the long-dashed step function $OA'B'C'D'E'$ stands for the distribution of discretionary income generated from the rural development policy using B dollars. In contrast, the income distribution for the reduced cost policy using the same budget is displayed by short-dashed lines and labeled by $OA''B''C''D''E''$. As can be seen, Y_2 is

higher than Y_1 in segments OA' and B'C', but lower than Y_1 in A'B' and C'D'. The other segments are the same for both distributions. Therefore, according to the first-order welfare dominance criterion, we may conclude that the income distribution resulted from RD policy neither welfare-dominates the distribution resulted from RC policy nor is welfare-dominated by it. That is, we cannot make unambiguous policy evaluation judgment about which of the two policies is better to improve the income distribution solely based on the first-order dominance criterion.

Case 2: Multiplier effect (M) of rural development policy is sufficiently large. That is, one dollar budget allocated to an agriculture worker could generate a large income increase.

In this case, the discretionary income of rural hukou holders working in the private sector would be larger under rural development policy than reduced cost policy with the same amount of budget. Accordingly, Y_2 would be indeed lower than Y_1 in Segment 1. The specific reason is stated in Appendix 5b. What is the cutoff value of M to distinguish the two cases discussed above? M is equal to the cutoff value when the discretionary income of rural hukou holders working in the non-SOE is the same under rural development policy and the reduced cost policy. Appendix 5c gives us the expression of M^* . Case 1 is corresponding to the situation where $1 \leq M < M^*$, while case 2 is

corresponding to $M > M^*$. The graph of the two quantile distributions generated by the two policies in Case 2 is shown below.

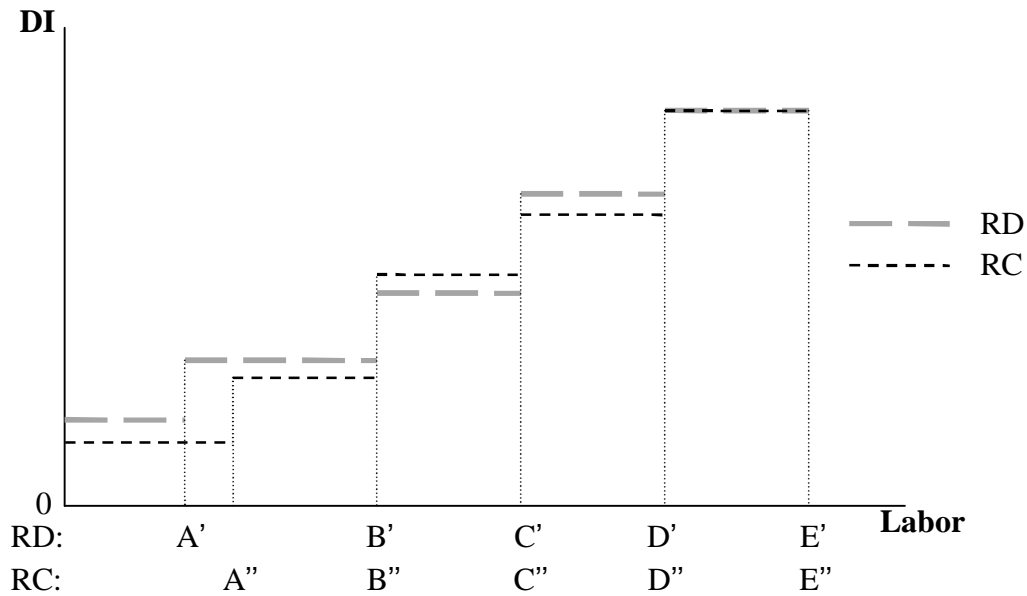


Figure 5.5b Comparison of Income Distributions under Rural Development (RD) and Reduced Cost (RC) (M is large)

As can be seen, although Y_1 generated by the rural development policy is higher than Y_2 in most segments, it is still lower than Y_2 (generated by reduced cost policy) in $B'C'$. Hence, in both cases, the income distribution resulted from rural development policy neither welfare-dominates the distribution resulted from reduced cost policy nor is welfare-dominated by it. That is, we cannot make unambiguous policy evaluation judgment about which of the two policies is better to improve the income distribution solely based on the first-order dominance criterion.

5.4.3.2 Comparison of rural development and hukou conversion

Following the same procedure as above, we compare the income distributions generated by rural development and hukou conversion policies, respectively. According to the results displayed in Figure 5.2 and 5.4, Segment 3 and 5 are the same for both Y_1 and Y_3 , including the length (horizontal) and position (vertical). In Segment 4, Y_1 lies above the original distribution, whereas Y_3 lies below the original distribution. Thus, Y_1 should lie above Y_3 in Segment 4. Moreover, Y_1 is shorter in Segment 4 than Y_3 . For Segment 2, Y_1 lies above the original distribution, whereas Y_3 coincides with the original in terms of vertical position. Hence, Y_1 should lie above Y_3 in Segment 2. Using the same logic, we conclude that Y_1 lies above Y_3 in Segment 1. However, it is not obvious to see which distribution is shorter in Segment 1, because both the RD and HC policies decrease the number of rural hukou holders working in the private sector in the urban area (E_{NS}^R), and we do not know yet which policy would generate a relatively larger decrease.

Case 1: Multiplier effect (M) of rural development policy is sufficiently small. That is, one dollar budget allocated to an agriculture worker could generate a small income increase.

Again, we examine the extreme case $M=1$. In Appendix 6a, I show that if $M=1$, the hukou conversion policy indeed reduces E_{NS}^R by a larger amount than the rural development policy does. Thus, more people with rural hukou would work in the private sector under the rural development policy than under the hukou conversion policy. In summary, we obtain the following graph showing the two quantile distributions resulted from rural development and hukou conversion policies, respectively.

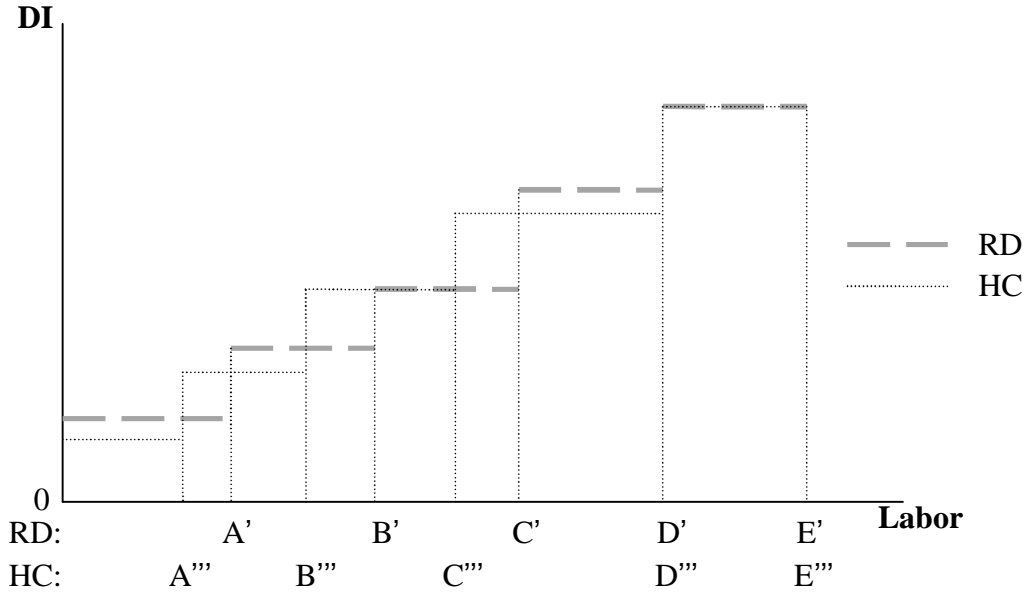


Figure 5.6a Comparison of Income Distributions under Rural Development (RD) and Hukou Conversion (HC) (M is small)

As can be seen, Y_3 (generated by HC policy) is higher than Y_1 (generated by RD policy) in segments $A'''A'$, $B'''B'$ and $C'''C'$, but lower than Y_1 in OA''' , $A'B'''$ and $C'D'$.

The other segments are the same for both distributions. This implies that the income distribution resulted from RD policy neither first-order welfare-dominates the distribution resulted from HC policy nor is first-order welfare-dominated by it.

Case 2: Multiplier effect (M) of rural development policy is sufficiently large. That is, one dollar budget allocated to an agriculture worker could generate a large income increase.

In this case, more people with rural hukou would work in the private sector under the hukou conversion policy than under the rural development policy. The specific reason is explained in Appendix 6b. The cutoff value of M to distinguish the two cases above is equal to M^{**} when the number of rural hukou holders working in the non-SOE sector is the same under rural development policy and hukou conversion policy. The mathematical expression of M^{**} is given in Appendix 6c. Accordingly, Case 1 is corresponding to the situation where $1 \leq M < M^{**}$, while case 2 is corresponding to $M > M^{**}$. The graph of the two quantile distributions generated by the two policies in case 2 is shown below.

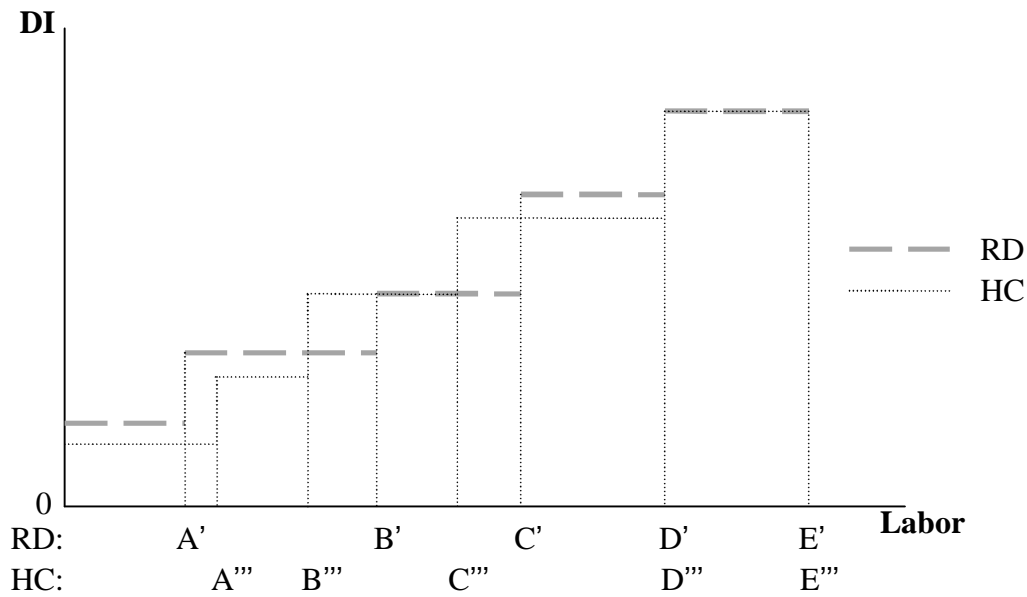
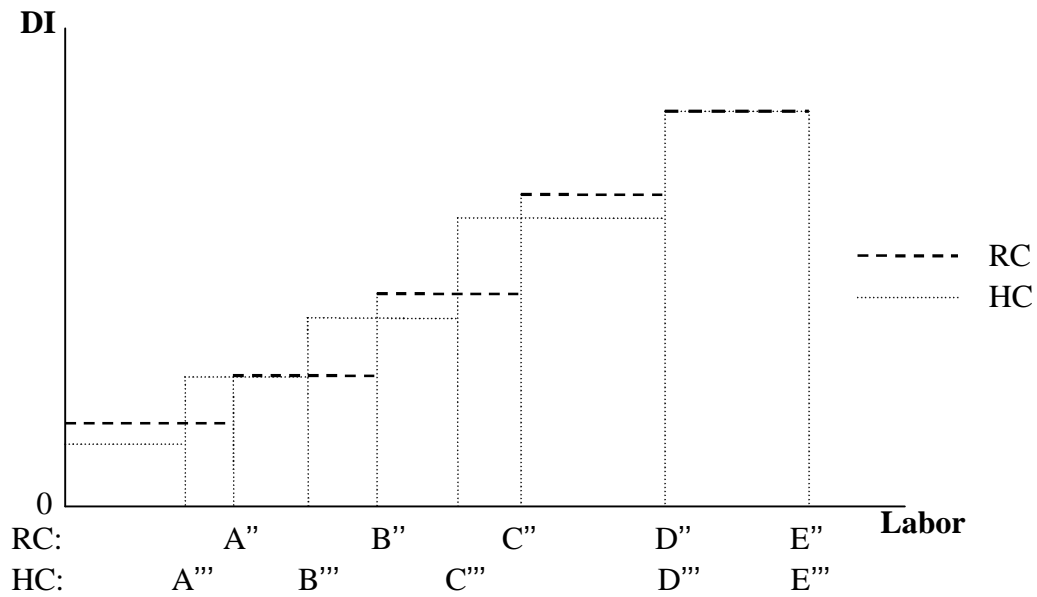


Figure 5.6b Comparison of Income Distributions under Rural Development (RD) and Hukou Conversion (HC) (M is large)

In this case, Y_3 (generated by HC policy) is higher than Y_1 (generated by RD policy) in segments B''B' and C''C', but lower in OB'' and C'D'. The other segments are the same for both distributions. To summarize, in both cases, the income distribution resulted from rural development policy neither welfare-dominates the distribution resulted from the hukou conversion policy nor is welfare-dominated by it. That is, we cannot make unambiguous policy evaluation judgment about which of the two policies is better to improve the income distribution solely based on the first-order dominance criterion.

5.4.3.3 Comparison of reduced cost and hukou conversion

According to the results displayed in Figure 5.3 and 5.4, Segment 5 is the same for both Y_2 (generated by RC) and Y_3 (generated by HC), including the horizontal length and vertical position. In Segment 3, Y_2 lies above the original distribution, whereas Y_3 coincides with the original in terms of vertical position. Therefore, Y_2 lies above Y_3 in Segment 3 with the same length. Because the agriculture wage is constant for both policies, Segment 2 has the same vertical location for Y_2 and Y_3 . In Segment 1, Y_2 lies above the original distribution, whereas Y_3 lies below the original distribution. Thus, Y_2 should lie above Y_3 in Segment 1. Moreover, Y_2 is shorter in Segment 1 than Y_3 . So far, we have not discussed Segment 4. The obvious result is that Y_3 is longer than Y_2 in this segment, but it is not obvious which one lies above the other. This is because both policies reduce the discretionary income of urban hukou holders employed in the non-SOE sector. For now, I assume that Y_2 lies above Y_3 in Segment 4. However, I will demonstrate later that the result of our welfare analysis is independent of this assumption. That is, no matter which distribution lies above the other in Segment 4, we will obtain the same result using the first-order dominance approach. Given the discussion above, we are able to draw the income distributions generated by RC and HC policies in Figure 5.7.



**Figure 5.7 Comparison of Income Distributions under
Reduced Cost and Hukou Conversion**

Figure 7 shows that Y_3 (generated by HC) is higher than Y_2 (generated by reduced cost) in segments $A''A''$, $B''B''$ and $C''C''$, but lower than Y_1 in OA'' , $B''C''$ and $C''D''$. The other segments are the same for both distributions. This implies that the income distribution resulted from RC policy neither first-order welfare-dominates the distribution resulted from HC policy nor is first-order welfare-dominated by it. Let us verify a previous claim that the result of our welfare analysis is independent of the assumption that Y_2 lies above Y_3 in Segment 4. It is obvious that even though Y_2 lies below Y_3 in Segment 4, other things being the same, we can still conclude that Y_2 neither first-order dominates Y_3 nor dominated by it. This is because even in the smaller range OC'' , Y_2 lies

above Y_3 in some parts but below it in other parts. If the two distributions cross with each other, then these two income distributions cannot be ordered using the first-order dominance.

In summary, according to the results in Section 5.4.3, no single distribution among Y_1 , Y_2 and Y_3 dominates either of the other two distributions. That is, none of the three policies (RD, RC and HC) with the same budget would result in an income distribution that first-order welfare-dominates either of the other two distributions generated by the other two policies. Thus, based on the first-order dominance criterion alone, we conclude that it is ambiguous which policy among the three alternatives the central government should choose with the fixed budget.

5.4.4 Pairwise policy comparison with a fixed budget using poverty dominance approach

What would happen if we relax our welfare criterion and only examine the effects of labor market policies on poverty? Atkinson (1987) and Foster and Shorrocks (1988) provided an important methodology called poverty dominance linking the first-order-dominance approach to the poverty measure. The first-order-poverty-dominance criterion should be described as follows: One distribution X first-order-poverty-dominates another distribution Y if and only if the quantile function

for X is below or equal to the quantile function for Y and strictly below someplace for all quantiles whose income are below or equal to the pre-specified highest possible poverty line (Z_{\max}). Thus, if X poverty-dominates Y , X has more poverty than Y and thus is not desired. Compared to the first-order-welfare-dominance approach, the poverty dominance only looks at a smaller income range. The smaller the Z_{\max} is, the more likely we will get the poverty dominance result. Furthermore, Atkinson (1987) and Foster and Shorrocks (1988) proved that X first-order poverty dominates Y if and only if $\text{pov}_X > \text{pov}_Y$ for all poverty measures belonging to general additive class specified below and for all poverty lines between 0 and Z_{\max} . Denote z as the poverty line, y_i as person i 's income, n as the total population, $p(z, y_i)$ as person i 's contribution to the poverty measure, and P as the poverty measure for the economy. Then the general additive class is:

$$(5) \quad P = \sum_{i=1}^n p(z, y_i) / n \quad \text{such that}$$

$$(i) \quad p(z, y_i) = 0 \text{ if } y_i \geq z;$$

$$(ii) \quad p(z, y_i) > 0 \text{ if } y_i \leq z.$$

This class includes the commonly used poverty measures such as poverty headcount ratio and P_a . We then apply the first-order-poverty-dominance criterion to the three income distributions generated by the three policies with the same amount of budget, respectively. To make the discussions and graphs clearer, we re-draw the truncated

quantile distributions of Y_1 , Y_2 and Y_3 and also divide the whole discussion into three pair comparisons, including Y_1 versus Y_2 , Y_1 versus Y_3 , and Y_2 versus Y_3 , respectively. I conduct the first-order-poverty dominance analysis below by assuming the highest poverty line larger than the agriculture wage under the rural development policy but less than the discretionary income for rural hukou holders in the SOE sector ($W_A' < Z_{\max} < DI_S^R$). People whose income are less than or equal to the specified poverty line are considered as poor. From the previous section, we know that the quantile distributions generated by the rural development policy would be different for different values of multipliers (M). Thus, for each specified highest poverty line Z_{\max} , there would be two cases categorized by the values of M . We will show the results of first-order poverty dominance for the two respective cases below.

Case 1: M is sufficiently small¹⁷.

In what follows, I compare the truncated quantile distributions generated by the three labor market policies. Recall that Y_1 , Y_2 , and Y_3 denote the quantile distributions resulting from rural development, reduced cost, and hukou conversion, respectively. Figure 5.8a displays the result of first-order-poverty-dominance analysis of Y_1 and Y_2 , Figure 5.8b shows the graphs for Y_1 and Y_3 , and Figure 5.8c is corresponding to Y_2 and Y_3 .

¹⁷ Precisely, M is sufficiently small meaning that $1 \leq M \leq \min\{M^*, M^{**}\}$; M is large meaning that $M \geq \max\{M^*, M^{**}\}$, where the expressions of M^* and M^{**} are given in Appendix 6c and 7c, respectively.

In the figures below, we focus on the shaded area for all quantiles whose income are below or equal to the pre-specified poverty line (Z_{\max}). One distribution X first-order-poverty-dominates another distribution Y if and only if the quantile function for X is below or equal to the quantile function for Y and strictly below someplace for all quantiles in the shaded area. Using this criterion, none of the three policies (RD, RC and HC) with the same budget would result in an income distribution that first-order-poverty-dominates either of the other two distributions generated by the other two policies. Specifically, Figure 5.8a informs us that although the distribution generated by rural development (RD) is higher than that generated by reduced cost policy in AC, it is lower in OA, rendering the ambiguous result. Similarly, accordingly to Figure 5.8b and 5.8c, no distribution is below or equal to the other function and strictly below someplace for all quantiles in the shaded area. Thus, in case 1, we cannot make a solid conclusion about which policy among the three alternatives the central government should choose with the fixed budget using the first-order-poverty-dominance criterion.

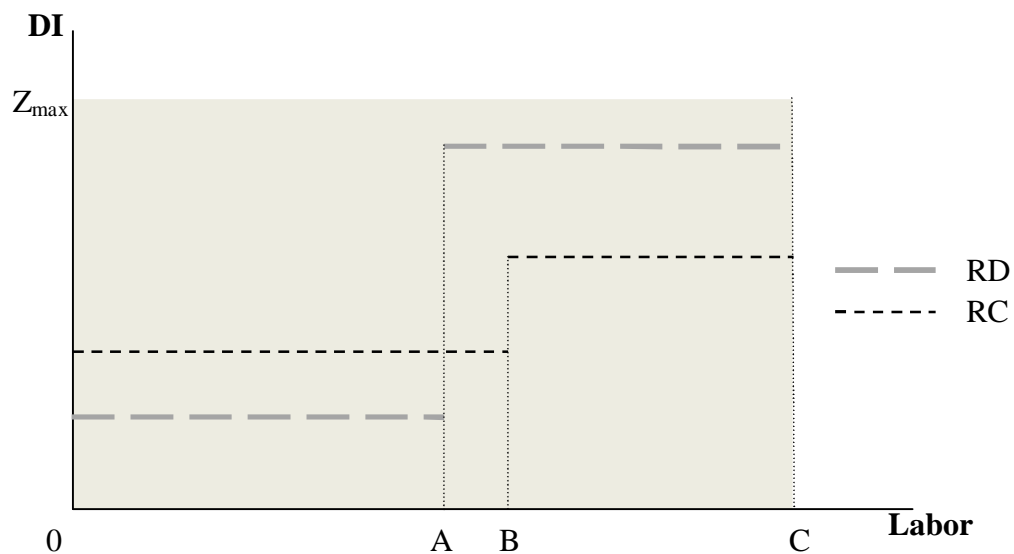


Figure 5.8a Poverty Dominance Analysis of Rural Development and Reduced Cost Policy (M is sufficiently small)

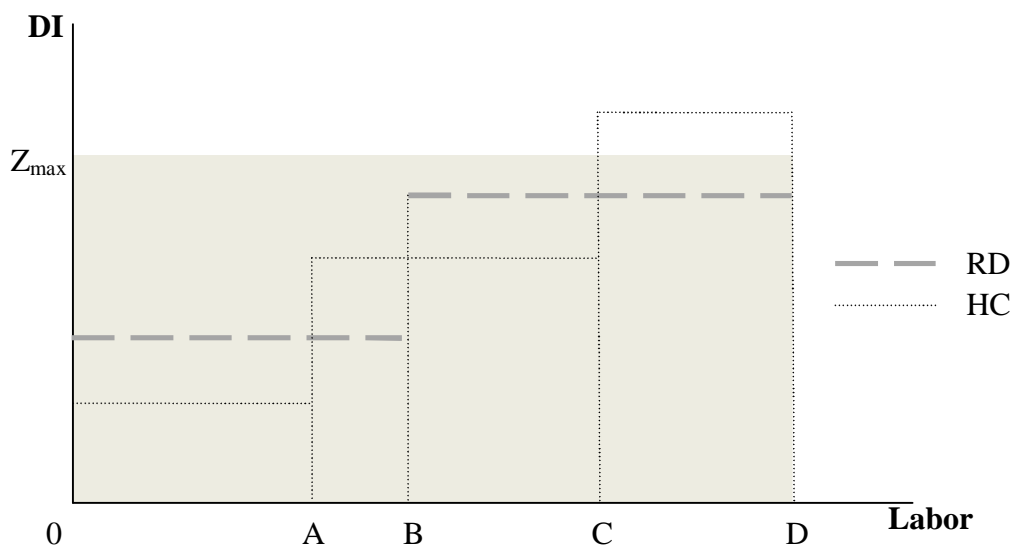


Figure 5.8b Poverty Dominance Analysis of Rural Development and Hukou Conversion Policy (M is sufficiently small)

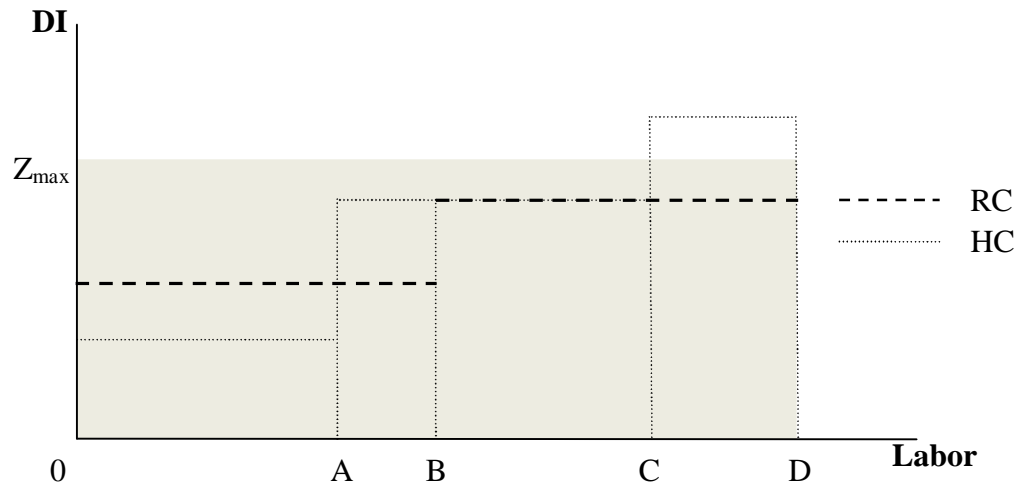


Figure 5.8c Poverty Dominance Analysis of Reduced Cost and Hukou Conversion Policy (M is sufficiently small)

Case 2: M is sufficiently large.

In this case, the graphs for the first two comparisons (RD and RC, RD and HC) would be different from Figure 5.8a and 5.8b. Figure 5.8c remains valid for comparing reduced cost and hukou conversion in this case. Figure 5.9a and 5.9b show the results of first-order-poverty-dominance analysis of RD and RC, RD and HC, respectively for case 2.

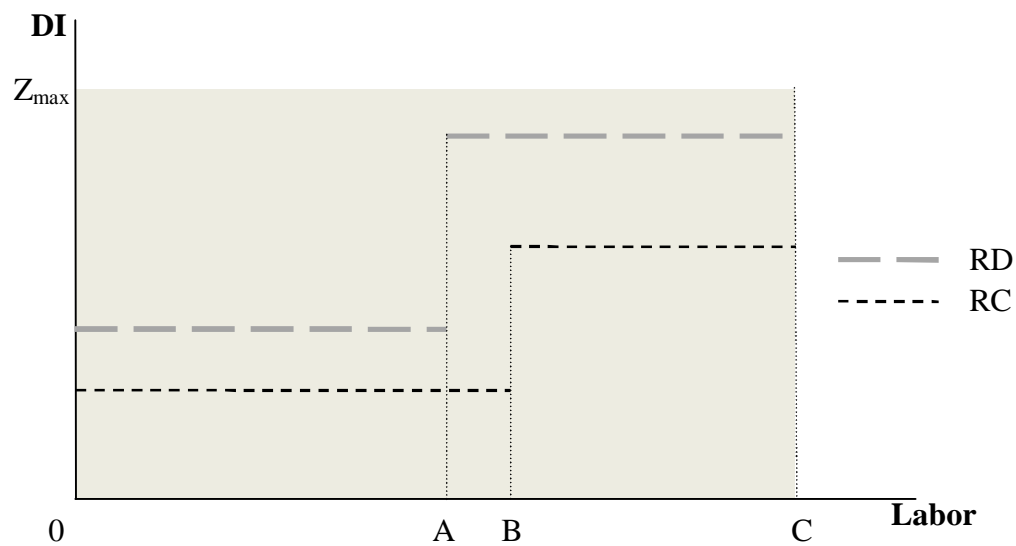


Figure 5.9a Poverty Dominance Analysis of Rural Development and Reduced Cost Policy (M is sufficiently large)

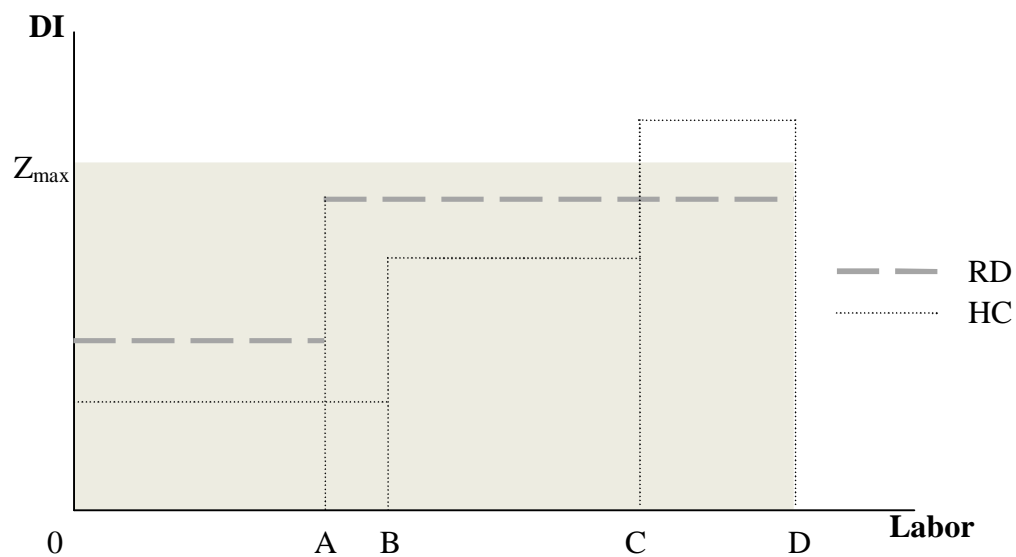


Figure 5.9b Poverty Dominance Analysis of Rural Development and Hukou Conversion Policy (M is sufficiently large)

Figure 5.9a shows that the income distribution generated by the reduced cost (RC) policy first-order-poverty-dominates the distribution generated by the rural development policy in that RC is strictly below RD for all quantiles whose income are below Z_{\max} (OC). However, Figure 5.9b shows the two quantile distributions are crossing for quantiles in the range OD. The very poor people are richer under RD than HC, but the richer of the poor people have higher income under HC than RD. Accordingly, neither the RD policy first-order-poverty-dominates the HC policy or dominated it.

Hitherto, we have analyzed the best allocation of B dollars among three alternative labor market policies using first-order welfare dominance and poverty dominance approach, respectively. Although the first-order-welfare-dominance criterion cannot give us the unambiguous result about which policy is the best in terms of improving social welfare, the first-order-poverty-dominance approach sheds more light on this policy question in different circumstances. Table 5.7 summarizes the results of the first-order poverty dominance analysis in a public finance framework.

Table 5.7 Results of First-Order-Poverty-Dominance Analysis

Highest poverty line (Z_{\max})	Value of M	Poverty-dominance result
$W_A' < Z_{\max} < DI_S^R$	Small M	No policy would generate an income distribution that first-order-poverty-dominates the distributions resulted from either of the other two policies
	Large M	The rural development policy has a larger effect on poverty reduction than the reduced cost policy. Neither the rural development policy first-order-poverty-dominates the hukou conversion policy nor dominated by it.

Note: W_A' is the agriculture wage under the rural development policy, which is larger than the original wage (W_A). DI_S^R is the discretionary income for rural hukou holders working in the high-wage sector (SOE) in the urban area. M is the multiplier effect of rural development policy meaning that one dollar budget allocated to an agriculture worker could generate M dollar income increase.

5.5 Concluding remarks

This paper has conducted a careful and comprehensive welfare economic analysis of three labor market policies using the new-developed labor market model for current China.

The three policies analyzed in this paper include: rural development (RD), reducing

the cost of living for rural hukou holders in the city (RC), and converting some rural migrants' hukou status from rural to urban (HC), which are the most discussed and relevant policies in the current Chinese labor market policy agenda. However, there has been no rigorous analysis using a well-specified China-specific model and distributionally sensitive social welfare criteria on whether each of the three policies above is desirable for the society or not, and also about which policy among the three alternatives should deserve priority. This paper utilizes a five-step policy evaluation framework created by Fields (2007a) to carefully investigate these policy questions. In Section 2 and 3, by ignoring the costs associated with implementing each policy, we adopted two alternative policy evaluation criteria to compare the income distributions generated by each of the three policies with the original distribution, respectively, answering the question that which policy would increase social welfare and which would not. In Section 4, we conducted a social cost-benefit analysis by taking into account of the costs of each policy, examining which policy the central government should choose given a fixed budget to increase social welfare measured by first-order-welfare-dominance and first-order-poverty-dominance approaches, respectively. The following conclusions can be drawn from these analyses.

First, according to the first-order-welfare-dominance criterion, none of the three policies is welfare-decreasing if the cost of each policy is ignored. However, only the

rural development policy yields an unambiguously welfare-improving income distribution, in that the income of people in each quantile after the rural development policy is at least as great as the income of people with the corresponding quantile in the original distribution without any policy change and strictly greater someplace. The reduced cost policy and *hukou* conversion policy have ambiguous effects on social welfare using the first-order-welfare-dominance approach in that neither the distribution generated by each policy first-order-welfare-dominates the original distribution nor dominated by it.

Second, according to the abbreviated social welfare function in which social welfare depends positively on total income, and negatively on income inequality and poverty, we have obtained similar results that only rural development policy unambiguously increases social welfare without taking into account the cost of each policy, while the other two policies have ambiguous effects on social welfare. Specifically, the reduced cost policy does reduce inequality, but it also makes the total income fall because more rural *hukou* holders would migrate to the city and the market-clearing wages in the urban private sector would decrease for workers with either urban or rural *hukou*. The *hukou* conversion policy has ambiguous effects on total income and income inequality, depending on parameters values.

Even without considering the cost of each policy, both welfare criteria above give ambiguous evaluations about reduced cost and *hukou* conversion policy. The reasons for the ambiguities are not the same in the two cases. In the dominance approach, workers in some quantiles have higher income under a proposed policy than under the original distribution, while some workers in other quantiles have lower income under the proposed policy than the original, rendering the crossing quantile distributions and thus ambiguous policy evaluation judgment. In contrast, according to the abbreviated social welfare function approach, the smaller total income that the reduced cost policy generates is valued negatively but the reduction in rural-urban inequality is valued positively. The *hukou* conversion policy also generates a welfare-ambiguous result in that it has ambiguous effects on total income and income inequality, depending on parameters values.

Third, we take into account the cost of each policy and examine which policy the central government should choose with a fixed budget to increase social welfare the most measured by first-order-welfare-dominance and first-order-poverty-dominance criteria, respectively. We compare the three hypothetical income distributions resulting from the three respective policies using the fixed amount of budget.

According to the first-order-welfare-dominance criterion, none of the three policies

with the same fixed budget would generate an income distribution that first-order-welfare-dominates the income distributions resulting from either of the other two policies. That is, no single policy among the three alternatives is unambiguously better than another one in the sense that it can make the income of the person in each quantile at least as great as the income of the person with the corresponding quantile in an income distribution generated by another policy and strictly greater someplace.

Fourth, by assuming that one dollar budget allocated to an agriculture worker for the rural development policy could generate M dollar income increase for each agriculture worker, we find that the results using first-order-poverty-dominance approach depend on how large the multiplier effect (measured by the value of M) is. If the multiplier is sufficiently small, no policy would generate an income distribution that first-order-poverty-dominates the distributions resulting from either of the other two policies. If the multiplier is sufficiently large, then the rural development policy has a larger effect on poverty reduction than the reduced cost policy. However, the rural development policy neither first-order-poverty-dominates the *hukou* conversion policy nor is dominated by it, in that the very poor people have higher income under the rural development policy than the *hukou* conversion policy, whereas the richer of the poor people have lower income under the rural development policy than the *hukou* conversion policy.

In summary, based on the newly-developed labor market model, we have answered the questions in this paper such that what would happen if a policy were implemented and what policy evaluation judgment could be derived using each specified policy evaluation criterion. As it turns out, the welfare evaluation of various policy alternatives depends critically on which welfare economic approach is adopted, and also on parameters values.

Overall, the results suggest that the rural development policy is the only policy which unambiguously increases social welfare using either first-order-welfare dominance or abbreviated social welfare function. Furthermore, the rural development policy is also the only policy among the three alternatives that has the desirable effect on each of the components in the abbreviated social welfare function approach, increasing total income, decreasing urban-rural income inequality, and reducing poverty.

Appendix:

Appendix 1: Proof of the results in Table 2

First we prove the changes on employment for each group of workers. Differentiate equation (A5) in Chapter 4 with respect to W_A . We have:

(A1)

$$b (L_U^{R*})^2 + 2 b(W_A + C^R)(L_U^{R*}) \frac{\partial L_U^{R*}}{\partial W_A} + (L^U - E_S^*) L_U^{R*} + [(W_A + C^R)(L^U - E_S^*) - b E_S^{R*} \bar{W}_S^R - bA] \frac{\partial L_U^{R*}}{\partial W_A} = 0.$$

By re-arranging terms, we get:

$$\begin{aligned} \text{(A2)} \quad \frac{\partial L_U^{R*}}{\partial W_A} &= - \frac{b (L_U^{R*})^2 + (L^U - E_S^*) L_U^{R*}}{2 b(W_A + C^R)(L_U^{R*}) + [(W_A + C^R)(L^U - E_S^*) - b E_S^{R*} \bar{W}_S^R - bA]} \\ &= - \frac{L_U^{R*} [b L_U^{R*} + (L^U - E_S^*)]}{2 b(W_A + C^R)(L_U^{R*}) + [(W_A + C^R)(L^U - E_S^*) - b E_S^{R*} \bar{W}_S^R - bA]} \\ &= - \frac{L_U^{R*} E_{NS}^*}{2 b(W_A + C^R)(L_U^{R*}) + [(W_A + C^R)(L^U - E_S^*) - b E_S^{R*} \bar{W}_S^R - bA]}. \end{aligned}$$

The last equality is obtained by re-arranging equation (A2) in Chapter 4, i.e.

$$L_U^U + b L_U^R - E_S = E_{NS}.$$

Substituting the expression of L_U^{R*} from equation (38) into (A2) above, we get:

(A3)

$$\frac{dL_U^{R*}}{dW_A} = \frac{-L_U^{R*} E_{NS}^*}{\sqrt{\left[b E_S^{R*} \bar{W}_S^R + b A - (W_A + C^R)(L^U - E_S^*) \right]^2 + 4b(W_A + C^R) E_S^{R*} [(L^U - E_S^*) \bar{W}_S^R - b A]}}$$

.

As can be seen, the numerator is negative, while the denominator is positive. So we have

$$(A4) \quad \frac{\partial L_U^{R*}}{\partial W_A} < 0.$$

Thus, if the agriculture wage increases, fewer people with rural hukou would migrate to the urban area. From equation (35) in Chapter 4, E_{NS}^{R*} would decrease as L_U^{R*} falls. That is, fewer rural hukou holders would be employed in the private sector. Additionally, by equation (36), the agricultural employment would increase. Since the employment levels in the SOE sector for workers with either hukou type is independent of the agricultural wage, they remain unchanged. Finally, by equation (34) in Chapter 4, the number of urban hukou holders working in the urban private sector would be unchanged as well since the total number of urban hukou holders is a constant.

Then we prove the changes on wages and discretionary income in Table 2. Because

there is no change on the cost of living for rural hukou holders in the city, the discretionary income moves in the same direction as wages for all groups.

By equation (A3) in Chapter 4, we know that W_{NS}^* inversely depends on L_U^{R*} . Accordingly, keeping other terms constant, W_{NS}^* would increase if L_U^{R*} falls. By equations (16) and (17) in Chapter 4, the wages for workers with urban and rural hukou in the private sector would both increase. The wages in the SOE sector are exogenously determined and thus unchanged. This completes the proof of the effects of the rural development policy, shown in Table 2.

Appendix 2: Proof of the results in Table 3

We follow similar procedure as in Appendix 1. First we prove the changes on employment for each group of workers. Differentiating equation (A5) in Chapter 4 with respect to C^R and re-arranging, we obtain:

$$(A5) \quad \frac{\partial L_U^{R*}}{\partial C^R} = - \frac{L_U^{R*} [b L_U^{R*} + (L^U - E_S^*)]}{2 b (W_A + C^R)(L_U^{R*}) + [(W_A + C^R)(L^U - E_S^*) - b E_S^{R*} \bar{W}_S^R - b A]}.$$

Again, substituting equation (A2) in Chapter 4 into the numerator in (A5) above and substituting equation (38) into (A5) above, we get:

(A6)

$$\frac{\partial L_U^{R*}}{\partial C^R} = \frac{-L_U^{R*} E_{NS}^{R*}}{\sqrt{[b E_S^{R*} \bar{W}_S^R + b A - (W_A + C^R)(L^U - E_S^{R*})]^2 + 4b(W_A + C^R)E_S^{R*}[(L^U - E_S^{R*})\bar{W}_S^R - b A]}}$$

.

As can be seen, the numerator is negative, while the denominator is positive. So we have

$$(A7) \quad \frac{\partial L_U^{R*}}{\partial C^R} < 0.$$

Thus, if the cost of living in the city falls for rural hukou holders, more people with rural hukou would migrate to the urban area. From equation (35) in Chapter 4, E_{NS}^{R*} would increase as L_U^{R*} rises. That is, more rural hukou holders would be employed in the private sector. Additionally, by equation (36) in Chapter 4, the agricultural employment would decrease. Since the employment levels in the SOE sector for workers with either hukou type is independent of C^R , they remain unchanged. Finally, by equation (34) in Chapter 4, the number of urban hukou holders working in the urban private sector would be unchanged as well since the total number of urban hukou holders is a constant.

Let us prove the changes on wages for each group of workers in Table 2. Again, by equation (A3) in Chapter 4, W_{NS}^* would decrease if L_U^{R*} rises and other terms remain

unchanged. Thus, by equations (16) and (17) in Chapter 4, the wages for workers with urban and rural hukou in the private sector would both decrease. The wages in the SOE sector and agricultural wage are exogenously determined and thus unchanged.

Finally, we prove the changes on discretionary income for each group in Table 2. For urban hukou holders in each sector and rural hukou holders in the agricultural sector, their wages are equal to their respective discretionary income by Table 1. Thus, they move in the same direction as their wage. Rural hukou holders working in the SOE sector would experience an increase in discretionary income because their wages remain unchanged and the cost of living in the city falls.

Given the available information, it is not straightforward to see whether the discretionary income for rural hukou holders working in the private sector (equal to $W_{NS}^R - C^R$) increases or decreases. As C^R decreases, W_{NS}^R also decreases. Thus, we have to do more work to determine how the difference between W_{NS}^R and C^R would change.

Essentially, we examine the sign of the following derivative: $\partial \frac{(W_{NS}^{R*} - C^R)}{\partial C^R}$. In what

follows, I prove that this derivative is in fact small than zero.

$$(A8) \quad \partial \frac{(W_{NS}^{R*} - C^R)}{\partial C^R} = b \frac{\partial W_{NS}^*}{\partial C^R} - 1, \text{ by equation (17) in Chapter 4}$$

By re-arranging equation (13) in chapter 4 and substituting it into (A8) above, we get:

$$(A9) \quad \partial \frac{(W_{NS}^{R*} - C^R)}{\partial C^R} = -\frac{bA}{(E_{NS})^2} \frac{\partial E_{NS}}{\partial C^R} - 1.$$

Substituting the expression of E_{NS} from equation (A2) in Chapter 4 (i.e., $E_{NS} = L_U^U + b L_U^R - E_S$) into (A9) above, we obtain:

$$(A10) \quad \partial \frac{(W_{NS}^{R*} - C^R)}{\partial C^R} = -\frac{bA}{(E_{NS}^*)^2} b \frac{\partial L_U^{R*}}{\partial C^R} - 1.$$

Substituting equation (A5) in Chapter 5 into (A10) and manipulating simple algebra, we can simplify our task as follows.

$$(A11) \quad b^2 W_{NS}^* L_U^{R*} < 2b L_U^{R*} (W_A + C^R) + (W_A + C^R)(L^U - E_S) - b E_S^{R*} W_S^R + bA.$$

Substituting $L^U - E_S = E_{NS} - b L_U^R$ (re-arranging equation A2 in Chapter 4), and $A = E_{NS}^* W_{NS}^*$ (re-arranging equation 13 in Chapter 4) into equation (A11) above, we need to prove:

$$(A12) \quad bL_U^{R*}(bW_{NS}^* - (W_A + C^R)) + bE_S^{R*}W_S^R - E_{NS}^*(W_A + C^R + bW_{NS}^*) < 0.$$

From Table 1, we know that $W_A > W_{NS}^R - C^R$, so $bW_{NS}^* - (W_A + C^R) < 0$. Therefore, our work is simplified to prove $bE_S^{R*}W_S^R - E_{NS}^*(W_A + C^R + bW_{NS}^*) < 0$. By empirical observations, I claim that $E_S^R < E_{NS}$. This is because very few people with rural hukou holders are working in the SOE sector in the city, so E_S^R is a small number. In addition, $E_{NS} = E_{NS}^U + bE_{NS}^R$. Indeed, even the number of urban hukou holders working in the non-SOE sector (E_{NS}^U) is larger than E_S^R in reality. So we can be very confident to argue that $E_S^R < E_{NS}$. Then, the task left is to prove:

$$(A13) \quad bW_S^R - (W_A + C^R + bW_{NS}^*) < 0.$$

By the assumption made on Table 1, $W_S^R - C^R < W_{NS}^*$. Multiplied by b on both sides, we have $b(W_S^R - C^R) < bW_{NS}^*$. Therefore, $bW_S^R - (C^R + bW_{NS}^*) < 0$. So $bW_S^R - (W_A + C^R + bW_{NS}^*) < 0$.

This completes the proof of the effects of the reduced cost policy, shown in Table 3.

Appendix 3: Proof of the results in Table 4

We follow similar procedure as in Appendices 1 and 2. First we prove the changes on employment for each group of workers. Differentiating equation (A5) in Chapter 4 with respect to L^U and re-arranging, we obtain:

$$(A14) \quad \frac{\partial L_U^{R*}}{\partial L^U} = \frac{E_S^{R*} \bar{W}_S^R - (W_A + C^R) L_U^{R*}}{2b(W_A + C^R) L_U^{R*} + (W_A + C^R)(L^U - E_S^*) - bE_S^{R*} \bar{W}_S^R + bA}.$$

Substituting equation (38) in Chapter 4 into (A14) above, we get:

$$(A15) \quad \frac{\partial L_U^{R*}}{\partial L^U} = \frac{E_S^R \bar{W}_S^R - (W_A + C^R) L_U^R}{\sqrt{\left[bE_S^R \bar{W}_S^R + bA - (W_A + C^R)(L^U - E_S) \right]^2 + 4b(W_A + C^R) E_S^R [(L^U - E_S) \bar{W}_S^R - bA]}}.$$

The denominator is obviously positive, so we next examine the sign of the numerator.

Combining equations (23) and (31) in Chapter 4, and re-arranging, we get:

$$(A16) \quad W_A = W_S^R \frac{E_S^R}{L_U^R} + W_{NS}^R \left(1 - \frac{E_S^R}{L_U^R} \right) - C^R.$$

Multiplied by L_U^R on both sides, and re-arranging, we obtain:

$$(A17) \quad E_S^R \overline{W_S^R} - (W_A + C^R) L_U^R = W_{NS}^R (E_S^R - L_U^R).$$

By equation (15) in Chapter 4, we have $(E_S^R - L_U^R) = -E_{NS}^R$. Substituting this into equation (A17), we have proved:

$$(A18) \quad E_S^R \overline{W_S^R} - (W_A + C^R) L_U^R = -W_{NS}^R E_{NS}^R.$$

Thus, by equation (15), the numerator is negative, and the denominator is positive, so we have:

$$(A19) \quad \frac{\partial L_U^{R*}}{\partial L^U} < 0.$$

Thus, if the number of urban hukou holders in the economy increases due to the hukou conversion policy, fewer people with rural hukou would be located in the urban area. From equation (35) in Chapter 4, E_{NS}^{R*} would decrease as L_U^{R*} falls. That is, fewer rural hukou holders would be employed in the private sector. Since the employment levels in the SOE sector for workers with either hukou type is independent of L^U , they remain unchanged. Moreover, by equation (34) in Chapter 4, the number of urban hukou holders working in the urban private sector would increase as the total number of urban hukou holders rises keeping other terms constant.

The only employment level not examined yet is agricultural employment. By equation (36) in Chapter 4, $E_R^{R*} = L_R^{R*} = L^R - L_U^{R*}$, it is not easy to see how the agricultural employment would change since both L^R and L_U^{R*} would fall due to the hukou conversion policy. Combining equation (1) in Chapter 4 and equation (36) above, we have $E_R^{R*} = L_R^{R*} = L - L^U - L_U^{R*}$. Differentiating with respect to L_U^{R*} , we get the following expression:

$$(A20) \quad \frac{\partial E_R^{R*}}{\partial L^U} = -1 - \frac{\partial L_U^{R*}}{\partial L^U}.$$

We already know that $\frac{\partial L_U^{R*}}{\partial L^U} < 0$ (by equation A19), and now we prove that $\frac{\partial L_U^{R*}}{\partial L^U} > -1$.

Combining equation (A14) and (A18), we have:

$$(A21) \quad \frac{\partial L_U^{R*}}{\partial L^U} = \frac{-W_{NS}^{R*} E_{NS}^{R*}}{2b(W_A + C^R)L_U^{R*} + (W_A + C^R)(L^U - E_S) - bE_S^{R*}\bar{W}_S^R + bA}.$$

Substituting $L^U - E_S = E_{NS} - bL_U^R$ (re-arranging equation A2 in Chapter 4) and $A = E_{NS} * W_{NS}^*$ (re-arranging equation 13 in Chapter 4) into equation (A21) above, we obtain:

$$(A22) \quad \frac{\partial L_U^{R*}}{\partial L^U} = \frac{-W_{NS}^{R*} E_{NS}^{R*}}{(W_A + C^R) E_{NS}^* - [E_S^{R*} W_S^R - (W_A + C^R) L_U^{R*}] + b E_{NS}^* W_{NS}^{U*}}.$$

Substituting equation (A18) into the denominator of equation (A22) and re-arranging, we have:

$$(A23) \quad \frac{\partial L_U^{R*}}{\partial L^U} = \frac{-W_{NS}^{R*} E_{NS}^{R*}}{[(W_A + C^R) E_{NS}^* + b E_{NS}^{R*} W_{NS}^{R*} + b E_{NS}^* W_{NS}^{U*}]}.$$

Because $W_{NS}^{R*} = b W_{NS}^{U*}$ and $E_{NS}^{R*} < E_{NS}^*$, $\frac{\partial L_U^{R*}}{\partial L^U} \in (-1, 0)$. Thus, by equation (A20), we have:

$$(A24) \quad \frac{\partial E_R^{R*}}{\partial L^U} < 0.$$

Thus, the agricultural employment would fall as the total number of urban hukou holders rises.

Next we prove the changes on wages and discretionary income in Table 4. Because there is no change on the cost of living for rural hukou holders in the city, the discretionary income moves in the same direction as wages for all groups. Again, the

wages in the SOE sector and agricultural wage are exogenously determined and thus unchanged. According to equation (A3) in Chapter 4, since E_s^* and A remain unchanged, it is not easy to see whether W_{NS}^* increases or decreases. We have to do more work to investigate how the wage would respond to the policy change. According to equation (A3) in Chapter 4, we look at the following derivative:

$$(A25) \quad \frac{\partial(L^U + bL_U^{R*})}{\partial L^U} = 1 + b \frac{\partial L_U^{R*}}{\partial L^U}.$$

Since we have proved above that $\frac{\partial L_U^R}{\partial L^U} \in (-1, 0)$, along with $b < 1$, we conclude that:

$$(A26) \quad \frac{\partial(L^U + bL_U^{R*})}{\partial L^U} > 0.$$

As a result, as L^U rises, $(L^U + bL_U^{R*})$ would also increase. By equation (A3) in Chapter 4, we conclude that W_{NS}^* would fall. By equations (16) and (17) in Chapter 4, the wages for workers with urban and rural hukou in the private sector would both decrease.

This completes the proof of the effects of the hukou conversion policy, shown in Table 4.

Appendix 4: Proof of the results in Table 5

In the abbreviated social welfare function specified in our paper, economic well-being depends positively on the total income earned by all workers, negatively on poverty, and negatively on income inequality. Again, income in this context will be measured by discretionary income defined as previously.

The three components in the abbreviated social welfare function are measured in the following way. Since there are five values of income throughout this economy, the total income of all workers is the sum of discretionary income earned by each group, and thus has the following expression:

$$(A27) \quad Total = W_S^U E_S^U + W_{NS}^U E_{NS}^U + (W_S^R - C^R) E_S^R + (W_{NS}^R - C^R) E_{NS}^R + W_A E_R^R.$$

By re-arranging equation (A16) above, we have:

$$(A28) \quad (W_S^R - C^R) E_S^R + (W_{NS}^R - C^R) E_{NS}^R = W_A L_U^R.$$

Combining equation (A28) with $L^R = L_U^R + L_R^R$ and $E_R^R = L_R^R$, the total discretionary income of this economy can be simplified as:

$$(A29) \quad Total = W_S^U E_S^U + W_{NS}^U E_{NS}^U + W_A L^R.$$

The second component in the specified welfare function is poverty headcount. Given the poverty line equal to W_A , the poverty headcount (PH) has the following expression:

$$(A30) \quad PH = E_{NS}^R + E_R^R.$$

The third component in the abbreviated social welfare function is income inequality measured by the difference in average discretionary income between workers living in the urban and rural area. Let AI_U and AI_R denote the average income in the urban and rural area, respectively. We know that $AI_R = W_A$, and AI_U has the following expression.

$$(A31) \quad AI_U = \frac{W_S^U E_S^U + W_{NS}^U E_{NS}^U + (W_S^R - C^R) E_S^R + (W_{NS}^R - C^R) E_{NS}^R}{L^U + L_U^R}.$$

Substituting equation (A28) into (A31), we have:

$$(A32) \quad AI_U = \frac{W_S^U E_S^U + W_{NS}^U E_{NS}^U + W_A L_U^R}{L^U + L_U^R}.$$

Let “ I ” represent the measure for income inequality and be calculated as the difference in average discretionary income between workers living in the urban and rural area. Thus,

$$\begin{aligned}
 (A33) \quad I &= AI_U - AI_R \\
 &= \frac{W_S^U E_S^U + W_{NS}^U E_{NS}^U + W_A L_U^R}{L^U + L_U^R} - W_A \\
 &= \frac{W_S^U E_S^U + W_{NS}^U E_{NS}^U - W_A L^U}{L^U + L_U^R}.
 \end{aligned}$$

Hitherto, we have specified the measures for each component in the abbreviated social welfare function. The results of policy analyses using this abbreviated social welfare function are proved in the subsequent sections of this appendix.

Appendix 4a: The results of the rural development policy

The effect of rural development on total income is easy to see from the result of dominance analysis. The total discretionary income is the total area below the quantile function. By Figure 5.2, we know that the new distribution lies above the original one. This implies that the total discretionary income of all workers would rise due to the rural development policy.

Poverty would decrease given an increase in W_A . Since the poverty line is set at the original agriculture wage W_A , the only group in poverty under rural development policy would be the rural hukou holders employed in the non-SOE sector in the urban area (E_{NS}^R), and workers in the agriculture sector would escape from poverty. Furthermore, because there would be fewer workers with rural hukou working in the non-SOE sector after the policy change ($E_{NS}^R < E_{NS}^R$), the poverty headcount would definitely decrease by equation (A30).

In terms of income inequality, we need to calculate the derivative of “ I ” with respect to W_A , and then to explore the sign of the derivative. We provide a detailed proof below showing that the derivative is indeed negative:

$$(A34) \quad \frac{\partial I}{\partial W_A} < 0.$$

Differentiate equation (A33) with respect to W_A , we get:

$$(A35) \quad \frac{\partial I}{\partial W_A} = \frac{(E_{NS}^U \frac{\partial W_{NS}^U}{\partial W_A} - L^U)(L^U + L_U^R) - (W_S^U E_S^U + W_{NS}^U E_{NS}^U - W_A L^U) \frac{\partial L_U^R}{\partial W_A}}{(L^U + L_U^R)^2}.$$

We know that the average urban income is higher than the average of rural income,

so $I > 1$, so $L^U + L_U^R < W_S^U E_S^U + W_{NS}^U E_{NS}^U - W_A L^U$. Since the denominator of equation (A35) is greater than zero, the only remaining task is to prove

$$(A36) \quad (E_{NS}^U \frac{\partial W_{NS}^U}{\partial W_A} - L^U) < \frac{\partial L_U^R}{\partial W_A}.$$

By equations (A2) and (A3) in Chapter 4, we have $\frac{\partial W_{NS}^U}{\partial W_A} = -\frac{b W_{NS}^U}{E_{NS}} \frac{\partial L_U^R}{\partial W_A}$.

Substituting this expression into above and manipulating the algebra, we need to prove:

$$(A37) \quad -\frac{\partial L_U^R}{\partial W_A} \left(\frac{b W_{NS}^U E_{NS}^U}{E_{NS}} + 1 \right) < L^U.$$

Substituting $L^U - E_S = E_{NS} - b L_U^R$ (re-arranging equation A2 in Chapter 4) and $A = E_{NS} * W_{NS}^*$ (re-arranging equation 13 in Chapter 4) into equation (A2) in this chapter, we obtain:

$$(A38) \quad \frac{\partial L_U^R}{\partial W_A} = \frac{-L_U^R E_{NS}}{(W_A + C^R) E_{NS} + b \left[(W_A + C^R) L_U^R - E_S^R \bar{W}_S^R \right] + b E_{NS} W_{NS}^U}.$$

Substituting equation (A18) in this chapter into the denominator of equation (A38) above and re-arranging, we have:

$$(A39) \quad \frac{\partial L_U^R}{\partial W_A} = \frac{-L_U^R E_{NS}}{(W_A + C^R)E_{NS} + bE_{NS}^R W_{NS}^R + bE_{NS} W_{NS}^U}.$$

Substituting equation (A39) into (A37) and re-arranging, we simplify our task to prove the following:

$$(A40) \quad L_U^R (bW_{NS}^U E_{NS}^U + E_{NS}) < L^U [(W_A + C^R)E_{NS} + bE_{NS}^R W_{NS}^R + bE_{NS} W_{NS}^U].$$

It is obvious to see that the inequality above holds, since $L_U^R < L^U$, and $E_{NS}^U < E_{NS}$.

Therefore, we have proved $\frac{\partial I}{\partial W_A} < 0$. This completes the proof.

Appendix 4b: The results of the reduced cost policy

According to equation (A29), the reduced cost policy would in fact reduce the total discretionary income, because W_{NS}^U would decrease given a decline in C^R (by Table 3), while all other terms on the right hand side of equation (A29) remain the same.

The policy has no effect on poverty in that the total number of workers being in poverty keeps constant. To see this more clearly, we look at the following expression:

$$\begin{aligned}
\text{(A41)} \quad PH &= E_{NS}^R + E_R^R \\
&= L^R - E_S^R \quad (\text{by equations 15 and 19 in Chapter 4}).
\end{aligned}$$

Obviously, the number of workers with rural hukou (L^R) and those working in the SOE sector (E_S^R) would not change due to the reduced cost policy, so poverty headcount would remain the same.

Urban-rural income inequality measured by equation (A33) would fall, because the numerator decreases (W_{NS}^U decreases) while the denominator increases (L_U^R increases). Therefore, the reduced cost policy would reduce income inequality.

According to the abbreviated social welfare function, although income inequality reduces with no change on poverty, the total income of all workers falls, rendering the social welfare judgment ambiguous.

Appendix 4c: The results of the hukou conversion policy

First we examine the changes of total income due to the reduced cost policy.

Differentiating equation (A29) in Chapter 3 with respect to L^U , we get:

$$\text{(A42)} \quad \frac{\partial Total}{\partial L^U} = \frac{\partial(W_S^U E_S^{U*} + W_{NS}^{U*} E_{NS}^{U*} + W_A L^R)}{\partial L^U}.$$

Substituting $L^U + L^R = L$ (equation 1 in Chapter 4) and $E_{NS}^U = L^U - E_S^U$ (equation 14

in Chapter 4) into above, we have:

$$(A43) \quad \frac{\partial Total}{\partial L^U} = E_{NS}^U \frac{\partial W_{NS}^U}{\partial L^U} + W_{NS}^U - W_A.$$

By equations (A2) and (A3) in Chapter 4, we have:

$$(A44) \quad \frac{\partial W_{NS}^U}{\partial L^U} = -\frac{W_{NS}^U}{E_{NS}} \left(1 + b \frac{\partial L_U^R}{\partial L^U}\right).$$

Substituting (A44) into (A43), we obtain:

$$(A45) \quad \frac{\partial Total}{\partial L^U} = -\frac{W_{NS}^U E_{NS}^U}{E_{NS}} \left(1 + b \frac{\partial L_U^R}{\partial L^U}\right) + W_{NS}^U - W_A.$$

Substituting equation (A23) in this chapter into (A45), we have

$$(A46) \quad \frac{\partial Total}{\partial L^U} = W_{NS}^U \frac{[(W_A + C^R) + bW_{NS}^U]bE_{NS}^R + bE_{NS}^R W_{NS}^R}{[(W_A + C^R) + bW_{NS}^U]E_{NS} + bE_{NS}^R W_{NS}^R} - W_A.$$

We know that $E_{NS} = E_{NS}^U + b E_{NS}^R$. Denote the ratio $\frac{bE_{NS}^R}{E_{NS}}$ as d . So $0 < d < 1$. We

consider the two limit values of d and look at the sign of the derivative above. If d approaches to 0, $\frac{\partial Total}{\partial L^U} = -W_A < 0$. If d approaches to 1, $\frac{\partial Total}{\partial L^U} = W_{NS}^U - W_A > 0$. As can be seen, the sign of the derivative depends on the hukou composition of labor force in the private sector.

The hukou conversion policy unambiguously reduces poverty for the following reason. Since L^U increases, holding the constant population, the number of rural hukou holders (L^R) falls. Furthermore, L^R consists of E_{NS}^R , E_R^R , and E_S^R . Because E_S^R does not change, the sum of E_{NS}^R and L_R^R would decrease. That is, the poverty headcount would decrease (by equation (A30) above in this Chapter).

Lastly, we prove the ambiguity of the sign of $\frac{\partial I}{\partial L^U}$. Differentiating equation (A33) in this chapter with respect to L^U , we get:

$$(A47) \quad \frac{\partial I}{\partial L^U} = \frac{[-\frac{W_{NS}^U E_{NS}^U}{E_{NS}}(1 + b \frac{\partial L_U^R}{\partial L^U}) + W_{NS}^U - W_A](L^U + L_U^R) - (W_S^U E_S^U + W_{NS}^U E_{NS}^U - W_A L^U)(1 + \frac{\partial L_U^R}{\partial L^U})}{(L^U + L_U^R)^2}.$$

The denominator is positive, so our task is prove the sign of the numerator is

ambiguous. From now on, we denote the numerator as “K”. We know from Appendix 3

that $\frac{\partial L_U^R}{\partial L^U} \in (-1, 0)$. Additionally, since K is linear in $\frac{\partial L_U^R}{\partial L^U}$, it is sufficient to consider the

two extreme cases of $\frac{\partial L_U^R}{\partial L^U}$ and look at the sign of the derivative above.

If $\frac{\partial L_U^R}{\partial L^U} \rightarrow -1$, $K = [-\frac{W_{NS}^U E_{NS}^U}{E_{NS}}(1-b) + W_{NS}^U - W_A](L^U + L_U^R)$. Furthermore, as $\frac{\partial L_U^R}{\partial L^U}$

approaches to -1, $b E_{NS}^R \rightarrow E_{NS}$. That is, workers in the private sector in the urban area

are mainly rural hukou holders. Because $E_{NS} = E_{NS}^U + b E_{NS}^R$, $E_{NS}^U \rightarrow 0$ in this case. Thus,

$$K \rightarrow (W_{NS}^U - W_A)(L^U + L_U^R) > 0.$$

On the other hand, if $\frac{\partial L_U^R}{\partial L^U} \rightarrow 0$, $E_{NS}^R \rightarrow 0$, so $E_{NS}^U \rightarrow E_{NS}$. Therefore, $K \rightarrow$

$$-W_A(L^U + L_U^R) - (W_S^U E_S^U + W_{NS}^U E_{NS}^U - W_A L^U) = -W_A L_U^R - (W_S^U E_S^U + W_{NS}^U E_{NS}^U) < 0. \text{ As can be}$$

seen, the sign of the derivative depends again on the hukou composition of labor force in

the private sector. If workers in the private sector in the urban area are mainly urban

hukou holders, the HC policy would reduce inequality. Otherwise, the hukou conversion

policy will increase inequality.

This completes the proofs of the results in Table 5.

Appendix 5a:

Proof of $(W_{NS}^R - C^R)_{RC} > (W_{NS}^R - C^R)_{RD}$.

The task is to prove that the discretionary income of rural hukou holders working in the non-SOE sector (i.e., $W_{NS}^R - C^R$) is higher under the RC policy than under the RD policy. From Figure 2 and 3, we know that both the RD and RC policies increase the discretionary income of this group. Thus, it is equivalent to prove that $\Delta(W_{NS}^R - C^R)_{RC} > \Delta(W_{NS}^R - C^R)_{RD}$, in which $\Delta(W_{NS}^R - C^R)$ denotes the post-policy discretionary income minus the original one without any policy. Owing to the assumption that B is not large enough to alter the order of the discretionary income of the five groups listed in Table 1, we use the derivatives to approximate the change in discretionary income for RD and RC policies as follows, respectively.

$$(A48) \quad \Delta(W_{NS}^R - C^R)_{RD} \approx \frac{\partial(W_{NS}^R - C^R)}{\partial W_A} \Delta W_A = \frac{\partial(W_{NS}^R)}{\partial W_A} \frac{B}{L_{R,RD}^R},$$

$$(A49) \quad \Delta(W_{NS}^R - C^R)_{RC} \approx \frac{\partial(W_{NS}^R - C^R)}{\partial(-C^R)} (-\Delta C^R) = (1 - \frac{\partial W_{NS}^R}{\partial C^R}) \frac{B}{L_{U,RC}^R}.$$

The last equality of the two equations above comes from the budget constraints specified in (2a) and (3a) in this chapter. Thus, our task becomes to prove

$\frac{\partial(W_{NS}^R)}{\partial W_A} \frac{B}{L_{R,RD}^R} < (1 - \frac{\partial W_{NS}^R}{\partial C^R}) \frac{B}{L_{U,RC}^R}$. We divide the proof below into two parts. First, we

prove $\frac{B}{L_{R, RD}^R} < \frac{B}{L_{U, RC}^R}$. The second step is to prove $\frac{\partial(W_{NS}^R)}{\partial W_A} < (1 - \frac{\partial W_{NS}^R}{\partial C^R})$.

Lemma 1: $L_{R, RD}^R > L_{U, RC}^R$.

$$(A50) \quad L_{R, RD}^R = L_R^R + \Delta L_{R, RD}^R = L_R^R - \Delta L_{U, RD}^R$$

$$\approx L_R^R - \frac{\partial L_U^R}{\partial W_A} \Delta W_A$$

$$= L_R^R - \frac{\partial L_U^R}{\partial W_A} \frac{B}{L_{R, RD}^R}.$$

The last equality comes from the budget constraint that $B = (\Delta W_A) L_{R, RD}^R$. Thus, we

have $L_{R, RD}^R = L_R^R - \frac{\partial L_U^R}{\partial W_A} \frac{B}{L_{R, RD}^R}$. Denote $I = \frac{\partial L_U^R}{\partial W_A}$, and we can solve for $L_{R, RD}^R$ using

equation (A50). The solution is as follows:

$$(A51) \quad L_{R, RD}^R = \frac{L_R^R + \sqrt{(L_R^R)^2 - 4BI}}{2}.$$

We already know that $I < 0$, so we have a positive and real root for $L_{R, RD}^R$ as above.

Similarly, we can derive the expression for $L_{U, RC}^R$.

$$(A52) \quad L_{U, RC}^R = L_U^R + \Delta L_{U, RC}^R$$

$$\approx L_U^R - \frac{\partial L_U^R}{\partial(C^R)} \frac{B}{L_{U,RC}^R}.$$

From equation (A7) in this chapter, we know that $\frac{\partial L_U^R}{\partial(C^R)} < 0$, so

$$L_{U,RC}^R = \frac{L_U^R + \sqrt{(L_U^R)^2 - 4BI}}{2}.$$

From empirical facts, the number of rural hukou holders in the city is roughly one third of the total number of rural hukou holders. Therefore, $L_R^R > L_U^R$. Thus, according to the expressions of $L_{R,RD}^R$ and $L_{U,RC}^R$ derived above, we have proved that $L_{R,RD}^R > L_{U,RC}^R$.

Lemma 2: $\frac{\partial(W_{NS}^R)}{\partial W_A} < (1 - \frac{\partial W_{NS}^R}{\partial C^R})$.

Proof: Since $\frac{\partial L_U^R}{\partial W_A} = \frac{\partial L_U^R}{\partial(C^R)}$, we have $\frac{\partial(W_{NS}^R)}{\partial W_A} = \frac{\partial W_{NS}^R}{\partial C^R}$ by equation (A3) in Chapter

4. Thus, the task is simplified to prove $\frac{\partial(W_{NS}^R)}{\partial W_A} < \frac{1}{2}$. From the proof in Appendix 4, we

know:

$$(A53) \quad \frac{\partial(W_{NS}^R)}{\partial W_A}$$

$$= \frac{b^2 W_{NS}^U L_U^R}{(W_A + C^R + b W_{NS}^U) E_{NS} + b^2 W_{NS}^U E_{NS}^R}, \text{ then substituting equation (11) in Chapter into this,}$$

$$\begin{aligned}
&= \frac{b^2 W_{NS}^U L_U^R}{(W_A + C^R + b W_{NS}^U) E_{NS}^U + 2b^2 W_{NS}^U E_{NS}^R + (W_A + C^R) b E_{NS}^R} \\
&< \frac{b^2 W_{NS}^U L_U^R}{(W_A + C^R + b W_{NS}^U) E_{NS}^U + 2b^2 W_{NS}^U E_{NS}^R}.
\end{aligned}$$

From the conditions for interior solutions examined in Chapter 4, $W_A + C^R > b W_{NS}^U$, so $W_A + C^R + b W_{NS}^U > 2b W_{NS}^U > 2b^2 W_{NS}^U$. In addition, the empirical facts in China indicate that E_{NS}^U is close to L_U^R in magnitude, so $(W_A + C^R + b W_{NS}^U) E_{NS}^U > 2b^2 W_{NS}^U L_U^R$. Moreover, since most of rural hukou holders in the city are working in the private SOE sector, $E_{NS}^R > \frac{1}{2} L_U^R$. As a result, $2b^2 W_{NS}^U E_{NS}^R > 2b^2 W_{NS}^U L_U^R$. Thus, we have:

$$\begin{aligned}
\text{(A54)} \quad & \frac{\partial(W_{NS}^R)}{\partial W_A} \\
& < \frac{b^2 W_{NS}^U L_U^R}{(W_A + C^R + b W_{NS}^U) E_{NS}^U + 2b^2 W_{NS}^U E_{NS}^R} \\
& < \frac{1}{2}.
\end{aligned}$$

According to the results from Lemma 1 and Lemma 2, we have proved

$$\frac{B}{L_{R,RD}^R} < \frac{B}{L_{U,RC}^R}, \text{ and } \frac{\partial(W_{NS}^R)}{\partial W_A} < (1 - \frac{\partial W_{NS}^R}{\partial C^R}). \text{ Therefore, } \frac{\partial(W_{NS}^R)}{\partial W_A} \frac{B}{L_{R,RD}^R} < (1 - \frac{\partial W_{NS}^R}{\partial C^R}) \frac{B}{L_{U,RC}^R}.$$

This completes the proof.

Appendix 5b:

When M is larger than 1, we have:

$$\Delta(W_{NS}^R - C^R)_{RD} \approx \frac{\partial(W_{NS}^R - C^R)}{\partial W_A} \Delta W_A = \frac{\partial(W_{NS}^R)}{\partial W_A} \frac{MB}{L_{R, RD}^R},$$

$$\Delta(W_{NS}^R - C^R)_{RC} \approx \frac{\partial(W_{NS}^R - C^R)}{\partial(-C^R)} (-\Delta C^R) = (1 - \frac{\partial W_{NS}^R}{\partial C^R}) \frac{B}{L_{U, RC}^R}.$$

Clearly, if M is arbitrarily large, $\Delta(W_{NS}^R - C^R)_{RD} > \Delta(W_{NS}^R - C^R)_{RC}$. Thus,

$$(W_{NS}^R - C^R)_{RD} > (W_{NS}^R - C^R)_{RC}.$$

Appendix 5c:

To get the expression of M*, we solve for the following equation.

$$\frac{\partial(W_{NS}^R)}{\partial W_A} \frac{MB}{L_{R, RD}^R} = (1 - \frac{\partial W_{NS}^R}{\partial C^R}) \frac{B}{L_{U, RC}^R}.$$

Denote $\frac{\partial(W_{NS}^R)}{\partial W_A} = \frac{\partial W_{NS}^R}{\partial C^R} = q = \frac{b^2 W_{NS}^U L_U^R}{(W_A + C^R + b W_{NS}^U) E_{NS} + b^2 W_{NS}^U E_{NS}^R}.$

So $M^* = (\frac{1-q}{q}) \frac{L_R^R + \sqrt{(L_R^R)^2 - 4BI}}{L_U^R + \sqrt{(L_U^R)^2 - 4BI}},$

where $I = \frac{\partial L_U^R}{\partial W_A} = \frac{-L_U^R E_{NS}}{(W_A + C^R) E_{NS} + b E_{NS}^R W_{NS}^R + b E_{NS} W_{NS}^U}.$

Appendix 6a:

Proof of $E_{NS, RD}^R > E_{NS, HC}^R$.

The task is to prove that the number of workers with rural hukou employed in the non-SOE sector (i.e., E_{NS}^R) is larger under the RD policy than under the HC policy with

the same amount of budget, B dollars. Because both the RD and HC policies decrease E_{NS}^R , it is equivalent to prove that the absolute value of the change in E_{NS}^R due to RD policy (compared to the original) is smaller than that due to the HC policy (compared to the original). That is, we need to prove $|\Delta E_{NS}^R|_{RD} < |\Delta E_{NS}^R|_{HC}$. Using the similar approximation technique used in Appendix 6, we have the following results:

$$|\Delta E_{NS}^R|_{RD} = |\Delta L_R^R|_{RD} = |\Delta L_U^R|_{RD} \approx \left| \frac{\partial L_U^R}{\partial W_A} \right| (\Delta W_A) = \left| \frac{\partial L_U^R}{\partial W_A} \right| \frac{B}{L_{R,RD}^R},$$

$$|\Delta E_{NS}^R|_{HC} = |\Delta L_U^R|_{HC} \approx \left| \frac{\partial L_U^R}{\partial L^U} \right| (\Delta L^U) = \left| \frac{\partial L_U^R}{\partial L^U} \right| \frac{B}{C^R}.$$

The remaining task is to prove $\frac{|\Delta E_{NS}^R|_{RD}}{|\Delta E_{NS}^R|_{HC}} < 1$. By substituting the expressions of the

two derivatives from previous sections into this ratio, we obtain:

$$\frac{|\Delta E_{NS}^R|_{RD}}{|\Delta E_{NS}^R|_{HC}} = \frac{L_U^R E_{NS}^R}{L_{R,RD}^R} / \frac{W_{NS}^R E_{NS}^R}{C^R}.$$

Again, we need to turn to the empirical facts in current China to approximate the magnitude of the parameters above. As is known, the number of rural migrants in the city is roughly one third of the total number of rural hukou holders. That is, $L_U^R \approx \frac{1}{2} L_R^R$.

Because $L_{R,RD}^R > L_R^R$, we should have $\frac{L_U^R E_{NS}^R}{L_{R,RD}^R} \leq \frac{1}{2} E_{NS}^R$.

Furthermore, from empirical observation, the cost of living for rural hukou holders is no more than one half of their wage. That is, $\frac{W_{NS}^R}{C^R} \geq 2$, so $\frac{W_{NS}^R E_{NS}^R}{C^R} \geq 2 E_{NS}^R$. In addition, $E_{NS} = E_{NS}^U + b E_{NS}^R$. We know that E_{NS}^U is similar to E_{NS}^R in magnitude, so it is safe to claim that $E_{NS}^U < 2 E_{NS}^R$. As a result, $E_{NS} < (2 + b) E_{NS}^R < 3 E_{NS}^R$. In summary, $\frac{L_U^R E_{NS}}{L_{R, RD}^R} \leq \frac{1}{2} E_{NS}^U < \frac{3}{2} E_{NS}^R$, whereas $\frac{W_{NS}^R E_{NS}^R}{C^R} \geq 2 E_{NS}^R$. Thus, $\frac{L_U^R E_{NS}}{L_{R, RD}^R} < \frac{W_{NS}^R E_{NS}^R}{C^R}$. Hitherto, we have proved $\frac{L_U^R E_{NS}}{L_{R, RD}^R} / \frac{W_{NS}^R E_{NS}^R}{C^R} < 1$. That is, $\frac{|\Delta E_{NS}^R|_{RD}}{|\Delta E_{NS}^R|_{HC}} < 1$. This completes the proof.

Appendix 6b:

When M is larger than 1, we have:

$$|\Delta E_{NS}^R|_{RD} = |\Delta L_{R, RD}^R|_{RD} = |\Delta L_U^R|_{RD} \approx \left| \frac{\partial L_U^R}{\partial W_A} \right| (\Delta W_A) = \left| \frac{\partial L_U^R}{\partial W_A} \right| \frac{MB}{L_{R, RD}^R},$$

$$|\Delta E_{NS}^R|_{HC} = |\Delta L_U^R|_{HC} \approx \left| \frac{\partial L_U^R}{\partial L^U} \right| (\Delta L^U) = \left| \frac{\partial L_U^R}{\partial L^U} \right| \frac{B}{C^R}.$$

Clearly, if M is arbitrarily large, $|\Delta E_{NS}^R|_{RD} > |\Delta E_{NS}^R|_{HC}$. Thus, $E_{NS, RD}^R < E_{NS, HC}^R$.

Appendix 6c:

To get the expression of M**, we solve for the following equation.

$$\left| \frac{\partial L_U^R}{\partial W_A} \right| \frac{MB}{L_{R, RD}^R} = \left| \frac{\partial L_U^R}{\partial L^U} \right| \frac{B}{C^R}.$$

Denote $\frac{\partial L_U^R}{\partial L^U} = f = \frac{-E_{NS}^R W_{NS}^R}{[(W_A + C^R) + bW_{NS}^U]E_{NS} + bE_{NS}^R W_{NS}^R}.$

So $M^{**} = \frac{f}{l} \frac{[L_R^R + \sqrt{(L_R^R)^2 - 4BI}]}{2C^R} = \frac{E_{NS}^R W_{NS}^R}{L_U^R E_{NS}} \frac{[L_R^R + \sqrt{(L_R^R)^2 - 4BI}]}{2C^R},$

where $l = \frac{\partial L_U^R}{\partial W_A} = \frac{-L_U^R E_{NS}}{(W_A + C^R)E_{NS} + bE_{NS}^R W_{NS}^R + bE_{NS} W_{NS}^U}.$

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Chapter 6 Conclusion

This dissertation elaborates in great detail on how the current Chinese labor market is functioning and what policy actions should be taken to achieve distributional objectives in China.

The literature review in Chapter 2 provided a detailed investigation of these 10 features and served as a solid foundation for constructing a theoretical labor market model. These ten features are listed as below.

1. Nearly half of total labor force in China is working in rural areas and the other half is working in urban China; Within rural areas, more than one half of the rural labor force is still working in agriculture sector, and the rest is working in rural non-agriculture sector concentrated in eastern China; Within urban labor force, more than three quarters are working in private sector.

2. Urban and rural wages have been both increasing, but urban wages have grown much faster than rural wages, and now the average urban wage is approximately four times as high as the average rural wage.

3. Workers with different hukou face different costs of living in cities and have

different access to government-provided public service and welfare programs in the urban area.

4. Workers with rural hukou earn lower wages and are less likely to be hired in the high-wage sector in urban areas compared to workers with local urban hukou due to both differences in human capital and labor market discrimination.

5. The phenomena of urban labor shortage and rural labor surplus are co-existent in the current Chinese labor market.

6. Open unemployment is low in China and is mainly concentrated in cities of central and western China.

7. There exists labor market segmentation between rural and urban labor market as well as within urban labor market between different ownerships

8. Wages in urban private sector are largely market-determined, and institutional interventions play a small role in wage-setting mechanism.

9. Skilled workers have experienced a much larger wage increase than unskilled

workers.

10. Only about 10 percent of urban labor force in China is self-employed, but a substantial share of urban workers is not covered by social insurance programs.

Chapter 3 makes a comparison of hukou-based labor market discrimination against rural hukou holders in two ownership sectors (SOE and private) by using a double-selectivity approach to account for the endogeneity of hukou status as well as sector determination. The results show that for observationally-equivalent workers, urban hukou holders earn about 50% more than rural hukou holders do in the SOE sector, but only 5% more in the private sector. In addition, there exists obvious hiring discrimination against rural hukou holders in the SOE sector. Comparable workers with rural hukou are 35 percentage points less likely to be hired in the high-wage SOE sector than urban hukou holders. This phenomenon can be best explained by the tasted-based discrimination theory. The SOEs discriminate rural hukou holders more than the private firms do because they are protected by the government and shielded from competitive market forces.

Based on central features of the current Chinese labor market, Chapter 4 of the dissertation constructed a three-sector labor market model with wage dualism, unique

hukou system, and labor market discrimination, which is the hitherto most detailed and rigorous theoretical model particularly for the Chinese labor market.

The model makes large contributions to the current literature and provides several valuable insights on the current Chinese labor market at least in the following aspects.

First, this model elaborates how the hukou system indeed affects the functioning of the current Chinese labor market. Almost all of the previous literature on modeling Chinese labor market only claimed that hukou system was a major institutional restriction on labor mobility, but did not explain how it actually works. The hukou system was similar to a black box which previous researchers had never explored for the purpose of modeling China's labor market.

Second, this model explains the puzzle of the co-existence of urban labor shortage and rural labor surplus. As we know, the wage in the coastal cities of China is obviously higher than that in the inland rural area. Furthermore, the non-SOE sector in the coastal urban area pays the market-clearing wage to avoid unemployment. However, why do a considerable number of rural hukou holders still choose to stay in the poor rural area and earn very little, instead of migrating to the coastal city for higher wages and guaranteed employment? The model developed in this chapter exactly answered this question. There

are two suggested reasons. One is that the labor market discrimination in the SOE sector limits the opportunities for rural hukou holders and thus reduces their expected payoffs associated with migrating to the city. Another reason is that due to hukou constraints, rural hukou holders have to bear a large amount of cost in the city, but cannot enjoy much social benefit as urban hukou holders does. These two reasons together reduce rural migrants' expected payoffs, and thus make some rural hukou holders prefer to stay in the rural area with lowest wages in the economy.

Finally, the model developed in this chapter could serve as a solid foundation for helping us analyze income distribution of an economy from labor market perspective. The multi-sector model constructed in this chapter with the central features of the current Chinese labor market enables us to analyze the effects of labor market policies on the whole income distribution.

Based on the newly-developed theoretical model, Chapter 5 then conducted a careful and comprehensive welfare economic analysis of three labor market policies, including rural development (RD), reducing the cost of living for rural *hukou* holders in the city (RC), and converting some rural migrants' *hukou* status from rural to urban (HC).

In the first place, by ignoring the costs associated with implementing each policy, I

adopt two alternative policy evaluation criteria including first-order welfare dominance approach and abbreviated social welfare function to compare the income distributions generated by each of the three policies with the original distribution, respectively, answering the question that which policy would increase social welfare and which would not. Secondly, I conduct a social cost-benefit analysis by taking into account of the costs of each policy and using a public finance framework, examining which policy the central government should choose given a fixed budget to increase social welfare the most measured by first-order-welfare-dominance and first-order-poverty-dominance criteria, respectively. The following conclusions are drawn from these analyses.

First, according to the first-order-welfare-dominance criterion, only the rural development policy yields an unambiguously welfare-improving income distribution. The reduced cost policy and *hukou* conversion policy have ambiguous effects on social welfare using the first-order-welfare-dominance approach in that neither the distribution generated by each policy first-order-welfare-dominates the original distribution nor dominated by it. None of the three policies is welfare-decreasing using the first-order welfare dominance criterion.

Second, according to the abbreviated social welfare function in which social welfare depends positively on total income, and negatively on income inequality and poverty, we

obtain similar results as above that only rural development policy unambiguously increases social welfare, while the other two policies have ambiguous effects on social welfare.

Third, we take into account the cost of each policy and examine which policy the central government should choose with a fixed budget to increase social welfare the most measured by first-order-welfare-dominance and first-order-poverty-dominance criteria, respectively. We compare the three hypothetical income distributions resulting from the three respective policies using the fixed amount of budget. The budget is assumed to be not large enough to change the ordering of discretionary income among groups in the original equilibrium before any policy interventions.

According to the first-order-welfare-dominance criterion, none of the three policies with the same fixed budget would generate an income distribution that first-order-welfare-dominates the income distributions resulting from either of the other two policies. That is, no single policy among the three alternatives is unambiguously better than another one.

Fourth, by assuming that one dollar budget allocated to an agriculture worker for the rural development policy could generate M dollar income increase for each agriculture

worker, we find that the results using the first-order-poverty-dominance approach depend on how large the multiplier effect (measured by the value of M) is. If the multiplier is sufficiently small, no policy would generate an income distribution that first-order-poverty-dominates the distributions resulting from either of the other two policies. If the multiplier is sufficiently large, then the rural development policy has a larger effect on poverty reduction than the reduced cost policy. However, neither the rural development policy first-order-poverty-dominates the *hukou* conversion policy nor dominated by it, in that the very poor people have higher income under the rural development policy than the *hukou* conversion policy, whereas the richer of the poor people have lower income under the rural development policy than the *hukou* conversion policy.

I hope that this dissertation can serve as a solid theoretical foundation which may lead to at least three strands of future research. First, this dissertation serves as a basis for more empirical studies on the Chinese labor market in the future. By reviewing numerous articles and books on the Chinese labor market, I find that the labor market research is still in its infancy in China. The critical literature review in Chapter 2 sheds light on what empirical questions need to be further addressed on the current Chinese labor market.

Second, the theoretical model constructed in the dissertation can be extended in

several important ways to capture some other features of the Chinese labor market. For example, the model contains only one urban area in eastern China and one rural area in inland China. As we know, the rural non-agriculture employment (called township and village enterprises, TVE for short) is widespread in rural areas of eastern China, which is not included in the model. Another possible extension of the model is to allow for on-the-job search meaning that workers located in rural areas have a positive chance of being hired by urban employers.

Third, analyses of other policies can be conducted using an extended theoretical model. One possibility is to provide rural hukou holders with more education and training (increase b), and to test its welfare consequence. In addition, it would be also interesting to examine the labor market outcomes and welfare consequences of removing labor market discrimination in state-owned enterprises in urban China. In summary, we can conduct additional policy analyses based on the theoretical model constructed in this paper.